BİRUNİ UNIVERSITY

"Future of Science"

9th (Online) International Conference on Applied Analysis and Mathematical Modeling

ICAAMM21 June 11-13, 2021
Istanbul-Turkey

Abstracts Book

Editors
Mustafa Bayram
Aydın Seçer

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9th (Online) International Conference on Applied Analysis and Mathematical Modeling ($\mathcal{ICAAMM}$21) June 11-13, 2021, Istanbul-Turkey

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Prof. Dr. Mustafa Bayram
Prof. Dr. Aydın Seçer

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Participant Statistics

297 participants from 41 different countries attended the conference, 54 of them from Turkey and the others from abroad, so 82% participants are foreigners and 18% participants are Turkish.

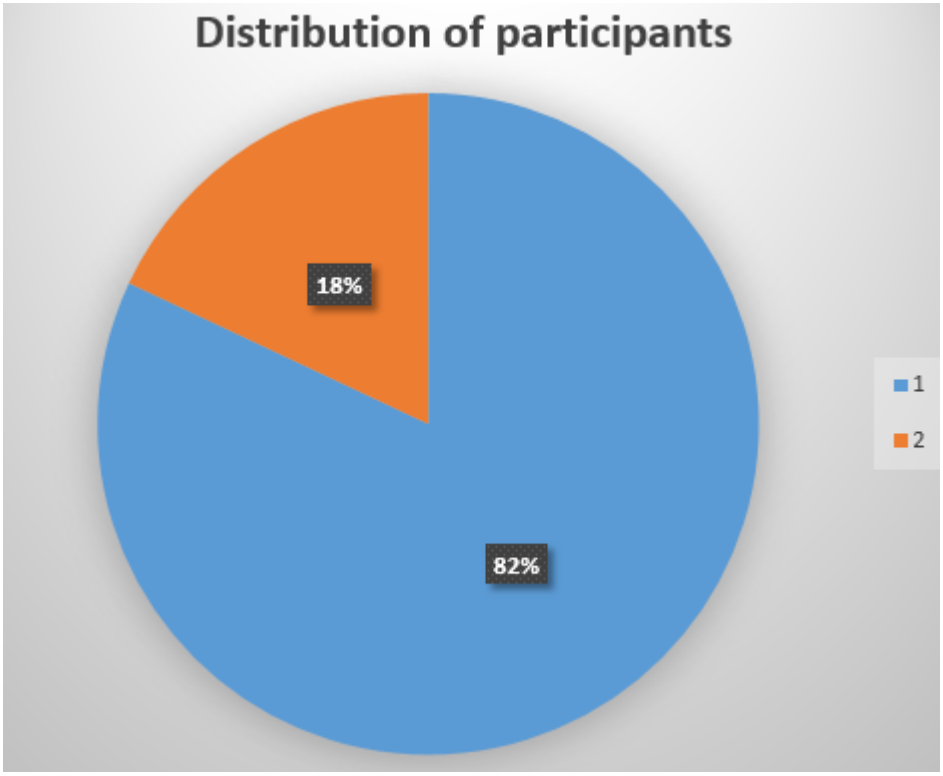

Figure 1: 1. Foreign participants, 2. Turkish participants

Contents

MESSAGE FROM CHAIRMAN

The "9th(Online) International Conference on Applied Analysis and Mathematical Modeling, 2021" organized by Biruni University will be held on 11-13 June 2021 in Istanbul, Turkey. Due to the Covid-19 Pandemic, we could not meet face to face. For this reason, we decided to make it online by technology. The aim of this conference is to bring the Mathematics & Engineering Sciences community working in the new trends of applications of Mathematics together in a wonderful city of the world, Istanbul.

There have been quite a big number of applications from different part of the world and as you know when the number increase task of the organizing committee will increase. Thus it was a very difficult task to select and classify the abstracts for all the participants. We tried to do our best to accommodate many speakers in order to have a better and enjoyable research session which will provide more interactions, exchanges among the participants.

Besides the scientific program, we had some social activities (excursion boat trip, city tour, etc.) where we could continue some informal discussions that would serve the purpose of our meeting in such a short time. We had to cancel due to the pandemic. As we can see from the list of participants, many speeches by young researchers will also serve the purpose of this conference.

The talks will cover a wide range of mathematics and its applications such as analysis, algebra, statistics, computer mathematics, discrete mathematics, geometry, engineering, etc. as well as their use in modeling. We believe that this richness will provide the basis for interdisciplinary collaborations.

We also would very much thank to all presenters and participants for their interests in the conference and believe and hope that each of them will get the maximum benefit in terms of networking and interaction from this meeting.

We would like to thank Dumitru Baleanu, Aydin Secer, Tuğçem Partal, Neslihan Ozdemir, Melih Cinar, Handenur Esen and Ismail Onder all our colleagues who worked for the organization of the conference.

Finally, we also would to thank to chairman of the board of trustees of Biruni University and Prof. Dr. Adnan Yüksel the Rector of Biruni University which is Host University.

Further we thank to all the plenary speakers that kindly accepted our invitation and spend their precious time by sharing their ideas during the conference. We also thank to all members of organizing committee.

We apologize for any shortcomings or might not be mentioned unintentionally or may have been forgotten to be mentioned explicitly here. We really hope their kind understanding, we thank all and each individual that have put their effort to make this occasion possible.

We welcome each and every one of you again to this conference; we wish a enjoyable and productive conference and hope to meet again in future occasions.

Sincerely Yours,
Prof. Dr. Mustafa Bayram,
Conference Chair

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James Davenport, University of Bath, United Kingdom
Konstantinos Lazopoulos, National Technical University of Athens, Greece
Sverre Holm, University of Oslo, Norway
Dumitru Baleanu, Çankaya University, Turkey
Maslina Darus, Universiti Kebangsaan Malaysia, Malaysia
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Xiao Jun Yang, China University of Mining and Technology, China
Abdel Salam Gomaa Abdel Salam, Qatar University, Qatar
Md. Haider Ali Biswas, Khulna University, Bangladesh

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ORAL PRESENTATIONS

Applications of the extended $exp(-\varphi(\xi))-$expansion method to some non-linear fractional evolution equations

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Abstract: In this article, the new exact solutions of some non-linear fractional evolution equations have been obtained by using extended $exp(-\varphi(\xi))-$expansion method. The advantages of proposed method have been discussed. All solutions have been checked with the help of Mathematica program. Additionally, 3D- graphs have been drawn to observe different type of solutions.

Keywords: Nonlinear fractional evolution equations, New analytical wave solutions, Extended $exp(-\varphi(\xi))-$expansion method.
Mathematics Subject Classification: 35R11, 47J35.

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Determination of Material Deformation Rate Based on Artificial Intelligence using Surface Microstructure Images

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Abstract: Making evaluations on the ever-increasing data and thus obtaining meaningful outcome becomes more and more important in the digital age. Thanks to the recent advances in artificial intelligence technologies, processing this data and making predictions is very popular. Within the scope of this study, S235 JR steel, which is used in many areas such as bridges, railways, industrial buildings, vehicle manufacturing and oil-gas exploration stations, has been deformed at different rates in the laboratory environment. Microstructure images of the deformed materials were obtained with the help of a microscope after some metallographic processes. As a result of the study, it is aimed to contribute to the literature by creating a data set containing microstructure images of S235 JR steel, which has been deformed at different rates. In addition, Convolutional Neural Network (CNN) and Multilayer Artificial Neural Network (ANN) models, which are among the deep learning methods of artificial intelligence technology, were used to classify the deformation rates. In order to minimize the error in both deep learning models, Adam Optimization Algorithm has been preferred. The results obtained with the Adam Optimization Algorithm in CNN and Multilayer ANN models were compared and the highest success in the classification process was obtained in the CNN model.

Keywords: Artificial Intelligence, CNN, Multilayer YSA, S235 JR structural steel.
Mathematics Subject Classification: 1X234.

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On soliton solutions of some nonlinear Schrödinger equations

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Abstract: Nonlinear Schrödinger equations (NLSEs) arise in diverse areas such as engineering, biological and physical sciences. The obtaining of the exact solutions for various models represented by NLSEs has also a principal role in fluid dynamics, plasma, nuclear physics, and nonlinear optics. Especially, soliton solutions from these solutions have received quite an attention from researchers. In this study, we implement the Riccati-Bernoulli Sub ODE method in reporting the exact solutions of two nonlinear physical models. Therefore, for the equations, some singular periodic waves, dark and singular optical solitons solutions are derived. It can be reported that all solutions produced in this study satisfy the equation by replacing it in the corresponding main equation. Utilizing suitable values of the parameters, some of the obtained solutions are illustrated by three-dimensional (3D) and two-dimensional (2D) graphs with the help of the MAPLE software in order to demonstrate the importance in the real-world of the presented equations.

Keywords: Nonlinear Schrödinger equations, Riccati-Bernoulli Sub-ODE method, soliton solutions.
Mathematics Subject Classification: 35A24, 35C08, 35Q55.

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Application of Optimal Processes in the Nonlinear Stochastic Dynamical System

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Abstract: In this paper we firstly defined nonlinear stochastic binary dynamical system and investigated the optimal control problem given by the considered system.[1,2,3]. Then we proved a theorem concerning unique solution condition.[2,3] For simplicity, we illustrated the system characterization in the two-dimensional space by appliying shift operator.[4,5, 6].

Keywords: Optimal Control Problem, Stochastic Dynamical System.
Mathematics Subject Classification: 49L20, 93E20.

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Generating the novel analytical solutions of the system of partial differential equations with Conformable, M-truncated and Beta derivatives

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Abstract: In recent years, plenty of real-life problems have been modeled utilizing nonlinear partial differential equations. Furthermore, some of the nonlinear partial differential equations for exploring novel traits of real-life problems have been altered. In the past several decades, several researchers have analyzed that fractional differential equations are one of the best ways of clarifying real-life problems along with different engineering fields such as sensors, actuators, and many more. In this research, we study the novel traveling wave solutions and other solutions with conformable, M-truncated, and beta fractional derivatives for the nonlinear fractional system. The exact solutions of this system are acquired utilizing Riccati-Bernoulli sub-ODE method. A comparative approach is presented between the solutions with the fractional derivatives. For the validity of the solutions, the constraints conditions are determined. The 2D and 3D graphs of the acquired solutions are successfully charted by selecting appropriate values of parameters.

Keywords: Nonlinear fractional system, traveling wave solutions, Riccati-Bernoulli Sub-ODE technique.
Mathematics Subject Classification: 35A24, 35C07, 35R11.

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Elzaki Transform Adomian Decomposition Method to Obtain the Approximate Analytical Solutions of the Nonlinear Time-Fractional Coupled Burger's Equations

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Abstract: The Elzaki transform Adomian decomposition method is applied to obtain the approximate analytical solutions of the nonlinear time-fractional partial coupled Burger's equations. The fractional derivatives are defined in the Caputo sense. Numerical experiments are analyzed by ETADM. The graphs of the solutions of the nonlinear time-fractional partial coupled Burger's equations are plotted in the MAPLE software. The applications shows that ETADM is very effective method.

Keywords: Time-Fractional Coupled Burger's Equation, Elzaki Transform Adomian Decomposition Method, Mittag-Leffler Function.
Mathematics Subject Classification: 35F20, 35R11, 65R99.

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Exact Traveling Wave Solutions of Two Fractional Systems in Fluid Dynamics via the Exponential Rational Function Method

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Abstract: Nonlinear fractional differential equations have many important applications in applied sciences. The investigation of exact solutions of these equations are revealed many useful and effective analytical methods. In this study, the exponential rational function method is implemented to achieve two fractional systems' exact traveling wave solutions in fluid dynamics. The time-fractional derivatives are taken in terms of the conformable sense. The accuracy of achieved results and graphics are checked with the Mathematica software. This proposed method is reliable and innovative to obtain the exact solutions of equations with fractional order derivative.

Keywords: Exponential rational function method, nonlinear fractional partial differential equation, conformable fractional derivative, traveling wave solution.
Mathematics Subject Classification: 35R11, 35C07, 35Q35.

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Spreading or Contraction of Viscous Drops Between Plates; With and Without Rotation

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Abstract: The behaviour of a viscous drop squeezed between two horizontal planes (a contracting Hele Shaw cell) will be described by both theory and and experiment. For a constant squeezing force the ultimate growth of the radius a $\sim t^{(1/8)}$ with time t. An initially elliptic drop tends to become circular as t increases and is stable to small perturbations. For a reversed force, so that the plates are drawn apart, the boundary of the drop is subject to a fingering instability on a scale determined by surface tension. The effect of a trapped air bubble at the centre of the drop will also be described. The annular evolution of the drop under constant squeezing is still found to follow a "one - eighth" power law, but this is unstable, the instability originating at the boundary of the air bubble. If the plates are drawn apart, the evolution is still subject to the fingering instability driven from the outer boundary of the annulus. Fingering can also spread from the boundary of an interior trapped air bubble, and small cavitation bubbles appear in the very low pressure region far from the point of leverage. The effect of rapid rotation of the plates about a vertical axis will be described: unstable to fingering at the interface if no upper plate present; and totally stable if there is an upper plate. All these behaviors will be described, as well as being demonstrated by real time experiments and videos.

Keywords: viscous spreading; fluid instabilities; finite-time singularities; cavitation; effects of rotation.

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Upper and lower solution method for nth order BVPs on an infinite interval

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Abstract: This work is devoted to study a nth order ordinary differential equation on a half-line with Sturm-Liouville boundary conditions. The existence results of a solution and triple solutions are established by employing a generalized version of the upper and lower solution method, Schüuder fixed point theorem, and topological degree theory. In our problem the nonlinearity depends on derivatives, and we allow solutions to be unbounded, which is an extra interesting feature. To demonstrate the usefulness of our results we illustrate two examples.

A New Mathematical Approach for Determining Kinetic Parameters of Curing Process

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Abstract: We suggest, a new algorithm (GMN) for determining parameters of kinetic modelling which are pre-exponential and activation energy of curing process. This method includes the combine of tanh fitting for the measured conversion values via least squares minimization technique and linear fitting for the kinetic parameters. Experimentally determined differential scanning calorimetry (DSC) data sets for an epoxy resin functionalized by single wall carbon nanotubes are used for the verification of the proposed method. The results obtained from the proposed algorithm are also compared with the methods reported in the literature.

Keywords: Computational material science, Numerical methods, Numerical simulation.
Mathematics Subject Classification: 42A05, 42A10, 65L05, 74E40, 74E30.

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Existence of three positive solutions for nonlinear fractional boundary value problems with m point boundary conditions

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Abstract: This talk will be devoted to the existence of multiple positive solutions for nonlinear boundary value problems with m-point boundary conditions. Green' s function is obtained and some necessary inequalities of the Green' s function are derived. In the process, we use the Leggett-Williams fixed point theorem [1] to prove the existence of positive solutions. Finally, an example is presented to show the effectiveness of the main result.

Keywords: boundary value problems, fixed point theorems; integral boundary conditions.
Mathematics Subject Classification: 34B10, 34B18, 39A.

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Comparative Study of Different Fault-Tolerant Control Strategies for Three-Phase Induction Motor

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Abstract: In this paper, we have studied a different fault tolerant control (FTC) strategies for a three-phase induction motor (3p-IM). Further we introduce Backstepping controller (BC) and Input-output linearization controller (IOLC). To provide a direct comparison between these FTCs approaches, the performances are evaluated using the control of 3p-IM under failures, variable speed, and variable parameters. A comparison between the two control strategies is proposed to prove the most robust one. The simulation results show the robustness and good performance of the fault tolerant control with Input-output linearization controller compared to one with Backstepping controller. The FTC with IOLC is more stable and robust against failures, load torque perturbation and speed reversion.

Keywords: Three-phase induction motor (3p-IM), Fault Tolerant Control (FTC), Input-output linearization controller, Backstepping controller.
Mathematics Subject Classification: 12X34, 56Y78.

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The hidden role of the pre-symptomatic individuals in the transmission dynamics of COVID-19

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Abstract: : In this talk, a mathematical model with four different routes of transmission, namely, asymptomatic, pre-symptomatic, symptomatic and environmental transmissions, has been proposed and analyzed to investigate the role of pre-symptomatic individuals in the transmission dynamics of COVID-19 outbreak. Using the next generation matrix method, the basic reproduction number has been derived and then sensitivity analysis of the proposed model is presented. Existence and stability analysis of disease free and endemic equilibrium points have been discussed. Numerical simulations to demonstrate the effect of some model parameters related to pre-symptomatic transmission on the disease transmission dynamics have been carried out.

Keywords: COVID-19; Pre-symptomatic individuals; Basic Reproduction Number; Stability Analysis.
Mathematics Subject Classification: 34C23, 34D23, 92D30.

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Bell-Based Genocchi Polynomials

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Abstract: In this study, we introduce Bell-based Genocchi polynomials and then derive multifarious correlations and formulas including some implicit summation formulas and derivative properties.

Keywords: Genocchi polynomials, Bell polynomials, Mixed-type polynomials, Stirling numbers of the second kind.
Mathematics Subject Classification: 11B83, 11S80, 05A19.

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On Degenerate Truncated Frobenius-Euler Polynomials

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Abstract: In this study, we consider the truncated degenerate Frobenius-Euler polynomials. Then we examine diverse properties and formulas covering addition formulas, correlations and derivation property. Then, we derive some interesting implicit summation formulas.

Keywords: Degenerate exponential function, truncated exponential function, Frobenius-Euler polynomials, exponential generating function.
Mathematics Subject Classification: 11B73, 11B68, 33B10.

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Study of time fractional Black Scholes Schrodinger equation for two stocks in the light of Islamic vision

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Abstract: This paper represents the numerical and analytical results to get real and Imaginary option prices of two stocks in form of analytic infinite series by solving Schrödinger Black Schloes time fractional ordered PDE consisting two different stocks. For that reason, the appropriate numerical and analytical methods are discovered for the models that can be expressed as partial differential equations of integer and fractional orders, subjected to preliminary or boundary situations. The discussion have been presented after getting the solution for the time fractional Black-Scholes Schrdrnger equation for two stocks in the light of Islamic vision.

Keywords: Black-Scholes equation, Islamic option pricing, time fractional
Mathematics Subject Classification:

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Application of Extended Rational Sin-Cos and Sinh-Cosh Method for the System of Nonlinear Partial Differential Equations

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Abstract: In this research, system of the nonlinear partial differential equations with fractional order are studied. The system including both conformable and M-truncated fractional derivatives are solved. Trigonometric, dark and soliton solutions of the considered system are analytically obtained by the extended rational sin-cos and sinh-cosh method. We make a comparison between the solutions of the system with the conformable derivative and M truncated fractional derivative. The results are demonstrated in the 2D and 3D graphics.

Keywords: Extended rational sin-cos and sinh-cosh method , fractional conformable derivative, fractional M-trucated derivative.
Mathematics Subject Classification: 34K37, 35G50

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Numerical scheme for solving fractional integro-differential equations with Mittag-Leffler Kernel

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Abstract: In this work, we discussed a general class of fractional integro-differential equations that involve the Atangana-Baleanu derivative. The numerical scheme is developed for solving the aforementioned equations based on the shifted Vieta-Lucas polynomials. We utilize the operational matrices based on these polynomials to obtain a numerical solution of the considered equations. By approximating the unknown function and its derivative in terms of Vieta-Lucas polynomials and substituting these approximations into the original equation, the studied equation is transformed into a system of nonlinear algebraic equations. At the end of the study, some examples are included to show the accuracy and validity of the proposed method.

Keywords: Fractional integro-differential equations, Atangana-Baleanu derivative, Vieta-Lucas polynomials, Operational matrices.
Mathematics Subject Classification: 42B25, 31C15.

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Numerical schemes based on Legendre wavelets for Solving Nonlinear Partial Differential Equations

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Abstract: This study focuses on the solution of some partial differential equations by various methods. This purpose is accomplished by using the three-step wavelet Galerkin method and the three-step wavelet Collocation method. These methods are based on Legendre wavelets. These methods are the valuable and robust numerical methods that can be easily applied to linear and nonlinear problems. At the end of the study, the comparison between numerical and exact solutions proves the presented methods' efficiency and accuracy.

Keywords: Legendre Wavelets, Galerkin method, Collocation method, three-step Taylor method.
Mathematics Subject Classification: 65T60, 35Q53,65M60.

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Numerical Solution of Fractional Order Partial Differential Equation via Modified Laplace Method

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Abstract: In this study, numerical solutions of the fractional-order partial differential equations are investigated. The nonlinear partial equation has Caputo type fractional order. Numerical solutions are obtained by the modified Laplace decomposition method. Due to the ease of use of the mentioned method, significant and efficient results are obtained successfully. The solutions that have fractional order are compared with the behavior of the solutions that have integer order. 2D and 3D graphs express the results.

Keywords: Modified Laplace Decomposition Method, fractional nonlinear partial differential equations.
Mathematics Subject Classification: 35R11, 44A10.

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Mathematical Modeling for Optimal Control of COVID-19 with Combined Measures of Vaccination and Non-clinical Interventions

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Abstract: More than a year has been passed since the first cases of COVID-19 were reported in Wuhan, China and in that time, the virus has caused high mortality and tremendous interruptions to socio-economic activity. It has become the most important public health challenge humans have faced since the 1918 Spanish flu pandemic. Within weeks of emergence, the highly transmissible and deadly COVID-19 pandemic spread to every part of the world, so far accounting for over 169,094,393 confirmed cases and 3,512,509 deaths (as of May 27, 2021), in addition to incurring severe economic burden, social disruptions and other human stresses, globally. Although there is finally a little hope due to unprecedented progress in SARS-CoV-2 vaccine research and development, the current approved vaccines can only provide 50-95% protection in preventing symptomatic COVID-19 diseases which is much lower when it comes to reducing SARS-CoV-2 infection. At the same time, the emergence of new coronavirus strains may affect the current vaccine efficacy. So, until an effective preventative measure (such as 100% effective vaccine) has been developed, it is of great concern to develop disease management strategies, a better understanding of SARS-CoV-2 pathogenesis and population susceptibility to infection by applying non-pharmaceutical control strategy in terms of mathematical modeling which can provide a robust strategy to reduce the infection of COVID-19. In this talk, I will discuss our work on the mathematical modeling and analysis of the spread and control of COVID-19, with emphasis on the non-pharmaceutical preventive strategy in parallel to the currently-available and large scale implemented anti-COVID vaccines. Specifically, we will explore the importance of gaining self-immunity for the elimination of the pandemic taking immune boosting foods and drugs along with other non-pharmaceutical interventions, such as face masks usage, hand sanitizing and social-distancing.

Keywords: SARS-CoV-2, mathematical model, vaccination, non-pharmaceutical interventions, optimal control, maximum principle.
Mathematics Subject Classification:

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Statistical Approximation for Kantorovich Type q-Balázs-Szabados Operators

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Abstract: Balázs and Szabados studied approximation properties of the Bernstein type rational functions called the Balázs-Szabados operators. Different $q-$analogues of Balázs-Szabados operators are recently studied by several authors. New Kantorovich type$q-$analogue of the Balázs-Szabados operators are defined by Hamal and Sabancigil as follows:
$R^*_{n,q}(f,x) = \sum_{k=0}^{n} r_{n,k}(q,x) \int_0^1 f\left(\frac{[k]_q + q^k t}{b_n}\right) d_q t$, where $f : [0,\infty) \to \mathrm{R}$, $q \in (0,1)$, $a_n = [n]_q^{\beta-1}$,

$$b_n = [n]_q^{\beta},\ 0 < \beta \leq \frac{2}{3},\ \ n \in \mathrm{N},\ x \geq 0 r_{n,k}(q,x) = \frac{1}{(1+a_n x)^n} \left[\begin{array}{c} n \\ k \end{array} \right]_q (a_n x)^k \prod_{s=0}^{n-k-1} \left(1 + (1-q)[s]_q a_n x\right).$$

The following notions is due to Fast [2] and Fridy [3].
. A sequence $x = (x_n)$ is statistically convergent to the number L if for every $\varepsilon > 0$, $\delta\{k \in \mathrm{N} : |x_k - L| \geq \varepsilon\} = 0$ and we write $st_A - \lim_{n\to\infty} x_n = L$.
Let $C_B[a,b]$ be the space of all continuous functions at each point in $[a,b]$ and bounded on the entire positive real line that means $|f(x)| \leq M_f, \forall x \in (0,\infty)$, where$M_f$ is a constant depending on f.
Bohman –Korovkin type statistical approximation theorem was proved by Gadjiev and Orhan.
Now we present the main result for statistical convergence of the operators $R^*_{n,q}(f,x)$to f.
Theorem 2. Let $q = (q_n)_{n\in\mathrm{N}}$, $q_n \in (0,1)$, be a sequence $st_A - \lim_n q_n = 1$. Then for each compact interval $[0,b] \subset [0,\infty)$, we have $st_A - \lim_n \left\| R^*_{n,q}(f,x) - f(x) \right\| = 0$, $\quad \forall\ f \in C([0,b])$.

Keywords: $q-$Balázs-Szabados operators, Korovkin theorem, statistical approximation theorem
Mathematics Subject Classification: 47B65

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Sequential feature selection with machine learning techniques for heart disease diagnosing

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Abstract: In healthcare domain, the medical information treatment is very crucial for data acquisition, archiving, presentation and decision support services. For exploring these data, several techniques based on machine learning are utilized to predict a decision by building models. In this paper, we aim to develop an effective medical decision system based on machine learning techniques for heart disease detection. In this context, we used three different classification algorithms such as Decision Tree (DT), Support Vector Machines (SVM) and Linear Discriminant Analysis (LDA). In addition, we can seriously reduce the time, materials, and labor to get the final decision while increasing the prediction performance by using Sequential feature selection technique (SFS). Our experiments are conducted on real heart diseases dataset that has been collected to assess and analyze the risk factors. The obtained results show the effectiveness of the SFS technique with each classifier. Furthermore, our best system outperforms the well-known heart disease prediction methods in literature.

Keywords: Heart disease, prediction, Decision Tree, Support Vector Machines, Linear Discriminant Analysis, Sequential feature selection.
Mathematics Subject Classification: 1X234

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The Covid 19 Analysis With Taylor Matrix and Collocation Method

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Abstract: Early analysis of infectious diseases is very important in the spread of the disease [1]. The main aim of this study is to make important predictions and inferences for the current epidemic disease Covid 19, with mathematical modeling and numerical solution methods. We deal with the logistic growth model [2-6]. We obtain carrying capacity and growth rate with Turkey epidemic data. The obtained growth rate and carrying capacity is used in the Taylor collocation method. With this method, we estimate and make predictions close to reality with Maple. We also show the estimates with the help of graphics and tables.

Keywords: Logistic model, Covid-19, Taylor polynomials and series, Collocation points, Turkey.
Mathematics Subject Classification: 65H05.

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A review of clustering algorithms and application

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Abstract: There are many different tasks where it is important to find hidden groups in the data that are much easier to interpret than individual observations. This can be done using data clustering. According to Jain [1], the main goal of clustering is to perform accurate data grouping using observations, points, or objects. As well data clustering can be described as a machine learning method (unsupervised learning) that allows objects to be formed in groups (called clusters) while objects in different clusters are different. To assess the similarity of different observations, different distance measures are used. Distance between the two objects is smaller at which the observations are more similar to each other and vice versa. There are a particularly large number of clustering algorithms, so all these methods are divided into separate groups. According to Fraley and Raftery [2], data clustering can be distinguished into two main groups: hierarchical clustering and divisional clustering. Han and Kamber [3] propose to classify data clustering in a different way and distinguish the following groups: density-based methods, model-based methods, and grid-based methods. One of the most commonly used clustering algorithms is the k-means algorithm [4, 5], but this method does not always work properly. This method is usually suitable for distinguishing only observations that are spherical in shape. There are also many other clustering algorithms that are used in scientific research: UNIC [6], k-Medoids (PAM) [7], Gaussian Mixture [7], TCLUST [7], Trimmed k-means [8], Spectral Clustering, Density-Based Spatial Clustering, MULIC, DENCLUE, SOMs (NeuralNet), SVM, HIERDENC, Deep embedded clustering [9] and etc. However, all of these methods are often applied to specific tasks and are not universal, for this reason the aim of this paper is to introduce different clustering algorithms and present how these clustering algorithms work.

Keywords: clustering, machine learning, data science, k-means, DBSCAN
Mathematics Subject Classification:

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Quantization: Crossroads and Crossovers

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Abstract: Quantization is the mathematical procedure turning classical observables (functions on phase space) into quantum ones (often as self-adjoint operators). There exist various quantization techniques but they can be broadly classed into two: ones that are necessarily based on Hilbert spaces, and ones that do not. Of the former, there is geometric quantization, and the latter, deformation quantization and their various ramifications. We will discuss some of the pros and cons of these techniques and their interrelationships, with the focus on systems in external fields and noncommutative quantum mechanics.

Keywords: quantization, symplectic geometry, deformation of algebras, fibre bundles, gauge fields and noncommutative quantum mechanics.
Mathematics Subject Classification: 47B32, 46E22, 34A12, 74S30.

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Piecewise differential and integral operators: An approach to capture real world problems with crossover behaviors

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Abstract: Mankind relies on modeling to predict future behaviors of some problems occurring in nature. Due to the complexities of nature, several approaches have been introduced, for example deterministic, stochastics, probabilistic and fuzzy. Although the listed approaches have been applied with some success, the problem of crossover still remains a great challenge. Very recently the concept of piecewise differentiation and integration was introduced, our talk will therefore be devoted to the theory, methods and applications of this approach.

Robust Profile Monitoring for Phase II Profile Monitoring via Residuals

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Abstract: Many studies were conducted for fitting models using parametric and non-parametric techniques, in fact, their fits may be biased and have inflated the estimated variances when the model is misspecified, respectively. Thus, semi-parametric techniques are used for fitting models as they combine the advantages of parametric and non-parametric fits. In this study, we introduce model robust regression technique-2 (MRR2) for Phase II profile monitoring, namely the semi-parametric approach, where it is a combination of the parametric fit with a portion of a non-parametric residuals fit. Multivariate CUSUM (MCUSUM) chart unitized for monitoring the slope of linear mixed models in Phase II based on the random effects. A comprehensive simulation study performed to evaluate the proposed approach for correlated and uncorrelated profiles assuming different profile sizes, sample sizes and several model misspecification levels. Average Run Length (ARL) and Average time to signal (ATS) criteria were used for comparing the performances of the parametric, non-parametric and semi-parametric MCUSUM charts. The results showed that the semi-parametric chart had the best performance in detecting different shifts. Also, a real data application was conducted, where it showed that the semi-parametric chart had the highest sensitivity for the out-of-control scenarios.

Keywords: Linear Mixed Models; Penalized Spline; Model Misspecification; Profile Monitoring; MCUSUM; ARL; Average Time to Signal.
Mathematics Subject Classification:

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The Fear of COVID-19 Scale (FCV-19S): Multidimensionality Structure in Turkey Sample

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Abstract: The global pandemic, COVID-19, started on the last day of 2020 has brought new challenges. Researchers have started a great afford not only to try and find to this unexpected pandemic, but to also find its psychological impacts. Therefore, this study aimed to provide more validity and reliability evidence for the Fear of COVID-19 (FCV-19S) Scale. Using a large representative sample from Turkey, the results supported two-factor solution of the FCV-19S. This scale will allow researchers and health professionals to understand fear of COVID-19 using this multidimensional scale. The aim of the study was to evaluate the construct validity based on the internal structure, the relationship with other variables, and the internal consistency among items of the Fear of COVID-19 Scale (FCV-19S) in a sample of Turkısh peoples who are age of 18 and older. Future studies should be conducted in different population for more support.

Keywords: COVID-19, Fear, Confirmatory Factor Analysis, Measurement Invariance

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Test of divisibility by prime numbers via generalization of the famous criterion of divisibility by 3

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Abstract: Everywhere in nature and in life, prime numbers are very often used. For many years, prime numbers attract the attention of many mathematicians around the world, see for example the story of the theory of numbers in [1,5]. There are a number of well-known open questions regarding prime numbers. The creation of a real rule, trick, method or test of divisibility by a prime number is a very difficult elementary problem, there are currently various algorithms used for the test of divisibility, we can for example refer to [3,4,6] and [7,8,10]. In this article, especially using decimal system base, we study a new general recursive divisibility test by a prime number. Finally, as an example of applications, we discuses that the some specific known cases remain valid.

Keywords: Divisibility, congruence, prime, test.
Mathematics Subject Classification: 11A07; 11A41

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Dual Toeplitz operators on the orthogonal complement of the Hardy space

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Abstract: In this paper we investigate products of dual Toeplitz operators acting on the orthogonal complement of the Hardy space of the polydisk. In particular, we establish a Brown-Halmos type theorem and derive characterizations of the zero divisors among dual Toeplitz operators as well as symbols giving rise to isometric, idempotent and unitary dual Toeplitz operators.

Keywords: Brown-Halmos, dual Toeplitz operator, polydisk, Hardy space.
Mathematics Subject Classification: 47B35, 47B47.

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Positive Solutions for ϕ-Laplacian BVPs on bounded interval

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Abstract: Using an adapted version of the Krasnosels'kii fixed point theorem, we present new existence results for a ϕ-Laplacian boundary value problem of the type

$$\begin{cases} -(\phi(u'))'(x) = f(x, u(x), u'(x)), & 0 < x < 1, \\ u(0) - au'(0) = 0, & u'(1) = 0, \end{cases}$$

where $a > 0$, $f\colon [0,1]\times\mathbb{R}^+\times\mathbb{R} \to \mathbb{R}^+$ is a Carathéodory function and $\phi\colon \mathbb{R} \to \mathbb{R}$ is an increasing homeomorphism such that $\phi(0) = 0$. Some examples illustrate the results obtained.

Keywords: Positive solution, ϕ-Laplacian, BVPs, Fixed point theorems.
Mathematics Subject Classification: 47B35, 47B47

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Solving a coupled time -fractional partial differential equations by using generalized Gegenbauer -Humbert wavelets

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Abstract: In this paper, wavelets technique based on generalized Gegenbauer -Humbert polynomial are used for solving a coupled system of time–fractional Whitham–Broer–Kaup (WBK) and coupled Korteweg-de Vries (KdV) equations. An efficiency and accuracy of the present method are established by testing some numerical examples.

Keywords: Whitham–Broer–Kaup, Korteweg-de Vries.
Mathematics Subject Classification:

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Improved MPPT Based on Robust Backstepping Control via the Fractional-Order Step Size Incremental Conductance Algorithm

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Abstract: The increasing energy demands rely heavily on fossil fuels such as coal and natural gas, which have arisen the need for alternate clean energy. In this regard, solar energy becomes the trend in alternate energy sources. However, it keeps varying with solar irradiation and environmental temperature, so that it causes power low at the output of photovoltaic (PV) cells and a rapid wearing of electronic modules. As the solar cell is a sort of semiconductor, the interaction between the diffusion current and drift current of the semiconductor and the ambient temperature can be reflected in fractional order (FO) behavior. Correspondingly, to increase the efficiency of a PV power system, a robust backstepping controller based on Mittag-Leffler and Lyapunov stability is proposed to enhance the maximum power point tracking (MPPT) of the PV system. The designed controller is used to track the generated reference voltage for PV array which is determined under a fixed-fractional order step size incremental conductance algorithm, so that adjust the duty cycle of the boost converter. In this paper, MATLAB/Simulink is used to validate the desired result of the proposed controller. Consequently, the obtained results confirm the effectiveness of the designed controller and the significant performance of MPPT in transient and steady states under weather conditions.

Keywords: Fractional calculus, Photovoltaic system (PVs), MPPT, Robust Backstepping, Mittag-Leffler Stability, Fractional Lyapunov theory.
Mathematics Subject Classification: 26A33, 34A08, 90C32, 93B09, 33E12, 37B25

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Numerical Solutions of Nonhomogeneous Rosenau Type Equations by Quintic B-Spline Collocation Method

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Abstract: In this study, a numerical scheme based on a collocation finite element method using quintic B-spline functions for getting approximate solutions of nonhomogeneous Rosenau type equations prescribed by initial and boundary conditions is proposed. The numerical scheme is tested on four model problems with known exact solutions. To show how accurate the results the proposed scheme produces, the error norms defined by L_2 and L_∞ are calculated. Additionally, the stability analysis of the scheme is carrier out by means of the von Neuman method.

Keywords: Rosenau, Rosenau-Burger, Rosenau-RLW, Rosenau-KdV-RLW, quintic B-Spline functions, collocation method.
Mathematics Subject Classification: 65N35.

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Interior point methods for convex quadratic programming based on a new kind of kernel functions

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Abstract: In this work, we propose a new type of kernel function for convex quadratic programming problems. This kind was proposed for the first time by the authors themselves for semi-definite programming problems in [7]. By simple analysis tools, we compute the worst-case iterations complexity of the algorithm based on our proposed kernel function. The obtained iteration bound for large-update methods, namely, $O\left(n^{\frac{2}{3}}\log\frac{n}{\epsilon}\right)$, improves the classical iteration complexity [2] as well as first trigonometric kernel function [3], with a factor $n^{\frac{1}{3}}$. For small-update methods, we derive the iteration bound $O\left(\sqrt{n}\log\frac{n}{\epsilon}\right)$, which matches the currently best known iteration bound for small-update methods.

Keywords: Convex quadratic programming, Primal-dual interior point methods, kernel functions, Complexity analysis, Large- and small-update methods
Mathematics Subject Classification: 90C20, 90C31, 90C51, C60.

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Certain fractional integral and differential formulas involving the extended incomplete generalized hypergeometric functions

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Abstract: The fractional integral and differential operators involving the family of special functions have found significant importance and applications in various fields of mathematics and engineering. The goal of this chapter is to find the fractional integral and differential formulas (also known as composition formulas) of the extended incomplete generalized hypergeometric functions by using the generalized fractional calculus operators (the Marchichev-Saigo-Maeda operators). After that, we established their image formulas by using the integral transforms like: Beta transform, Laplace transform and Whittaker transform, respectively. Moreover, the reduction formulas are also considered as special cases of our main findings associated with the well known Saigo fractional integral and differential operators, Erdélyi-Kober fractional integral and differential operators, Riemann-Liouville fractional integral and differential operators and the Weyl fractional calculus operators, respectively.

Keywords: Fractional integral operators, fractional differential operators, Saigo fractional integral and differential operators , Erdélyi-Kober fractional integral and differential operators, Riemann-Liouville fractional integral and differential operators , Weyl fractional integral operator and differential , incomplete gamma Function, extended incomplete generalized hypergeometric function, Pochhammer symbol, Gamma function.
Mathematics Subject Classification: Primary 33B20, 44A20, 65R10; Secondary 26A33, 33C20

The bi-periodic high order numbers

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Abstract: We define a new class of the bi-periodic high order the r-Fibonacci sequence. Then, we introduce a new family of the companion of these sequences, named bi-periodic r-Lucas sequence of type s, which extend the classical Fibonacci and Lucas sequences. Afterwards, we establish the link between the bi-periodic r-Fibonacci sequence and its companion sequence. Furthermore, we give their basic properties linear recurrence relations, generating functions, Binet formulas and explicit formulas.

Keywords: Bi-periodic r-Fibonacci sequence, bi-periodic r-Lucas sequence, recurrence relation, generating function, explicit formula, Binet formula

Introduction Yazlik et al. [9] introduced generalization of the bi-periodic Fibonacci r-numbers (f_n), for r a positive integer and a, b a positive real numbers by, for $n \geq r+1$

$$f_n = \begin{cases} af_{n-1} + f_{n-r-1}, & for \quad n \equiv 0 \,(\mathrm{mod}\ 2), \\ bf_{n-1} + f_{n-r-1}, & for \quad n \equiv 1 \,(\mathrm{mod}\ 2), \end{cases}$$

and the bi-periodic Lucas r-numbers (l_n) by, for $n \geq r+1$

$$l_n = \begin{cases} bl_{n-1} + l_{n-r-1}, & for \quad n \equiv 0 \,(\mathrm{mod}\ 2), \\ al_{n-1} + l_{n-r-1}, & for \quad n \equiv 1 \,(\mathrm{mod}\ 2), \end{cases}$$

with the initial conditions $f_0 = 0, f_1 = 1, f_2 = a, ..., f_r = a^{\lfloor r/2 \rfloor} b^{\lfloor (r-1)/2 \rfloor}$ and $l_0 = r+1$, $l_1 = a, l_2 = ab, ..., l_r = a^{\lfloor (r+1)/2 \rfloor} b^{\lfloor r/2 \rfloor}$, respectively.
We define a new class of the bi-periodic r-Fibonacci sequence $(U_n^{(r)})_n$ and we give its linear recurrence relation. We introduce a new family of companion sequences associated to the bi-periodic r-Fibonacci sequence indexed by the parameter s; with $1 \leq s \leq r$; named the bi-periodic r-Lucas sequence of type s, $(V_n^{(r,s)})_n$. After that, we express $V_n^{(r,s)}$ in terms of $U_n^{(r)}$ and s. Then we give some algebraic properties.

The bi-periodic r-Fibonacci sequence In our work [1], first we define the bi-periodic r-Fibonacci sequence $(U_n^{(r)})_n$ and give its linear recurrence relation.

Definition 0.1. For a, b, c, d nonzero real numbers and $r \in \mathbb{N}$, the bi-periodic r-Fibonacci sequence $(U_n^{(r)})_n$ is defined by, for $n \geq r+1$

$$U_n^{(r)} = \begin{cases} aU_{n-1}^{(r)} + cU_{n-r-1}^{(r)}, & for \quad n \equiv 0 \,(\mathrm{mod}\ 2), \\ bU_{n-1}^{(r)} + dU_{n-r-1}^{(r)}, & for \quad n \equiv 1 \,(\mathrm{mod}\ 2), \end{cases} \tag{0.1}$$

with the initial conditions $U_0^{(r)} = 0, U_1^{(r)} = 1, U_2^{(r)} = a, \ldots, U_r^{(r)} = a^{\lfloor r/2 \rfloor} b^{\lfloor (r-1)/2 \rfloor}$.

The bi-periodic r-Fibonacci sequence can be expressed by linear recurrence relation.

Theorem 0.1. *For a, b, c, d nonzero real numbers and $r \in \mathbb{N}$, the bi-periodic r-Fibonacci sequence satisfies the following linear recurrence, for $n \geq 2r+2$*

$$U_n^{(r)} = abU_{n-2}^{(r)} + (a^{\xi(r+1)}d + b^{\xi(r+1)}c)U_{n-r-1-\xi(r+1)}^{(r)} - (-1)^{r+1}cdU_{n-2r-2}^{(r)}. \tag{0.2}$$

The bi-periodic r-Lucas sequence of type s Secondly, we introduce a new family of companion sequences related to the bi-periodic r-Fibonacci sequence, called the bi-periodic r-Lucas sequence of type s, $(V_n^{(r,s)})_n$.

Definition 0.2. For any nonzero real numbers a, b, c, d and integers s, r such that $1 \leq s \leq r$, we define for $n \geq r+1$

$$V_n^{(r,s)} = \begin{cases} bV_{n-1}^{(r,s)} + dV_{n-r-1}^{(r,s)}, & for \quad n \equiv 0 \,(\text{mod } 2), \\ aV_{n-1}^{(r,s)} + cV_{n-r-1}^{(r,s)}, & for \quad n \equiv 1 \,(\text{mod } 2), \end{cases}$$

with the initial conditions $V_0^{(r,s)} = s+1$, $V_1^{(r,s)} = a$, $V_2^{(r,s)} = ab, \ldots, V_r^{(r,s)} = a^{\lfloor (r+1)/2 \rfloor} b^{\lfloor r/2 \rfloor}$.

The bi-periodic r-Fibonacci sequence $(U_n^{(r)})_n$ and the bi-periodic r-Lucas sequence of type s, $(V_n^{(r,s)})_n$ can be seen as a generalization of the Fibonacci and Lucas sequences, we will list some particular cases. The bi-periodic r-Lucas sequence of type s, $1 \leq s \leq r$ satisfy the following linear recurrence relation.

Theorem 0.2. *For a nonzero real numbers a, b, c, d and s, r such that $1 \leq s \leq r$, the family of the bi-periodic r-Lucas sequence of type s satisfy, for $n \geq 2r+2$*

$$V_n^{(r,s)} = abV_{n-2}^{(r,s)} + (a^{\xi(r+1)}d + b^{\xi(r+1)}c)V_{n-r-1-\xi(r+1)}^{(r,s)} - (-1)^{r+1}cdV_{n-2r-2}^{(r,s)}. \tag{0.3}$$

After that, we express the bi-periodic r-Lucas sequence of type s, $V_n^{(r,s)}$ in terms of $U_n^{(r)}$.

Theorem 0.3. *Let r and s be nonnegative integers such that $1 \leq s \leq r$, the bi-periodic r-Fibonacci sequence and the bi-periodic r-Lucas sequence of type s satisfy the following relationship*

$$V_n^{(r,s)} = \begin{cases} U_{n+1}^{(r)} + sdU_{n-r}^{(r)}, & n \geq r, \quad for \ r \ odd, \\ U_{n+1}^{(r)} + scbU_{n-r-1}^{(r)} + scdU_{n-2r-1}^{(r)}, & n \geq 2r+1, \quad for \ r \ even. \end{cases} \tag{0.4}$$

Main results We also give the generating functions of the bi-periodic r-Fibonacci sequence and the bi-periodic r-Lucas sequence of type s. Then, we express an explicit formulas of $(U_n^{(r)})_n$ and $(V_n^{(r,s)})_n$. Finally, we give their Binet Formulas.

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Oscillatory behaviour of linear delay differential equation with nonmonotone arguments

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Abstract: We study a first order linear delay differential equation

$$x'(t) + \sum_{i=1}^{m} p_i(t)x(\tau_i(t)) = 0, \quad t \geq t_0, \qquad (E)$$

where $p_i(t)$ and $\tau_i(t)$ are the functions of nonnegative of real numbers and $\tau_i(t)$ are not necessarily monotone for $1 \leq i \leq m$. Then, we obtain new sufficient condition for the oscillatory solutions of (E). Finally, we give an example to demonstrate our result.

Keywords: Delay equation, nonmonotone arguments, oscillatory solution, nonoscillatory solution
Mathematics Subject Classification: 34K11, 34K06

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Fractional derivatives of generalized functions and hypergeometric functions

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Abstract: In this present study we review the fractional derivatives for some elementary and certain special functions and we generalize the idea of fractional operations to linear functional in the generalized functions spaces, [1] and [8]-[11]. We provide several examples in order to illustrate the geometric representation of fractional derivatives for Dirac delta type functions, [2]-[5]. Further we also give many counterexamples where the fractional derivatives of distributions need not necessarily to be elementary functions rather the hypergeometric functions, [6,7].

Keywords: Fractional derivatives; linear functional; Dirac delta function; generalized functions; hypergeometric functions.
Mathematics Subject Classification:

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A comparison of analytical solutions of a nonlinear PDE with conformable and $M-$ truncated derivatives

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Abstract: This paper aims to find exact solutions of a nonlinear PDE concerning various differential operators and compare the obtained solutions. The exact solutions of the PDE with the conformable and $M-$ truncated differential derivatives are obtained via extended rational $sine-cosine$ and $sinh-cosh$ methods. The results are compared in the $2D$ and $3D$ graphics. All computations and graphics are obtained by using Wolfram Mathematica 12.

Keywords: Analytical methods, nonlinear PDEs, conformable derivative, M- truncated derivative

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Hybridization of Neural Networks and Sine Cosine Algorithm for Better Classification

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Abstract: In this work, neural networks and sine cose algorithm are used in a hybrid approach in order to increase the quality of classification problems. The proposed method allows us to design the optimal neural network architecture, while avoiding overfitting. In order to evaluate the efficiency of the proposed algorithm, experimental results in two fields are presented. The hybridization technique produces two desirable effects, a better result and a fairly low margin of error.

Keywords: Artificial Intelligence, hybridization, classification, Neural Networks, Sine Cose Algorithm, Deep Learning.
Mathematics Subject Classification: 68T05, 68T20, 65K05

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Estimation of the Wada Property Based on the Weighted and Truncated Shannon Entropy and the Box-counting Technique

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Abstract: Over several decades, numerous investigations have been proposed in the field of basin structures of nonlinear dynamical systems and their boundary analysis [7, 2, 3]. When the single boundary separates three or more basins of attraction, it is said that such basins of attraction have a Wada property [2, 4]. In this case, a sufficiently small perturbation in any initial condition can make the system converge to another attractor – the behavior of the system becomes unpredictable [2, 3]. In the presentation, we will introduce a Wada index which enables to determine the number of different colors and their distribution in the phase space of the initial conditions and helps to estimate the Wada property. Wada index is based on the weighted and truncated Shannon entropy and the standard box-counting technique, what results in the unconditional stability of computations [5]. Such an index is easily applied not only for the identification of Wada boundaries in the phase space of dynamical systems, but also to evaluate the complexity of digital images of different nature. We will demonstrate the advantages of the proposed Wada index via series of numerical experiments with Newton fractal [6], nonlinear pendulum [3], completely invertible logistic map [8], and Beddington-DeAngel-type predator-prey models [4].

Keywords: Wada property, Shannon entropy, Nonlinear dynamical systems
Mathematics Subject Classification: 37F10, 37C70, 94A17

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Numerical simulation of a mathematical model of covid19 transmissibility in Morocco during vaccination period

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Abstract: The aim of this work is to develop a new Reservoir People(RP) transmission network model to simulate the potential transmission of the COVID-19 virus in the population of Morocco during the vaccination period. The proposed model is original since it contains parameters that depend on the period of vaccination that Morocco has adopted so far. After developing the mathematical model COVID- 19-Morocco, we define a cost function to minimize with respect to the parameters. Then, we use Neural Network Algorithm to optimize this functional. The obtained numerical simulation confirms that our model is robust and can predict the evolution of the virus in Morocco.

Keywords: Covid-19, mathematical model, basic reproduction number, metaheuristic optimization, Neural Network Algorithm, transmissibility, parameters identification.
Mathematics Subject Classification: 12X34,56Y78,92D30,92D25,35Q92,93A30

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A class of Fubini polynomials

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Abstract: The main object of this talk is to investigate a new class of generalized Fubini polynomials. Some relationships between generalized Fubini polynomials and more polynomials as Fubini, Bell, Eulerian and Frobenius-Euler polynomials are given. Also, we derive the probabilistic representation.

Keywords: Fubini polynomials, Stirling numbers, Bell polynomials, Eulerian polynomials, Frobenius-Euler polynomials, explicit formulas.
Mathematics Subject Classification: 05A19, 11B83, 33C45.

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Some Optical Soliton Solutions for Generalized Fokas- Lenells Equations

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Abstract: Soliton propagation studies in optical fibers have been flourishing because of the rich features of models describing these phenomena over the past few decades. In the field of optics, by careful selection of higher order nonlinear and linear effects, Fokas-Lenells equation (FLE) emerges as a model governing femtosecond pulse propagation through single mode silica optical fiber. Accordingly it is a useful model to understand the physical insight of ultra short pulses in media. It is one of the models that govern pulse transmissions technology first appeared about a decade ago. The existence of solitons in the nonlinear dispersive media has been studied within the framework of the FLE. Here, the model is considered in the presence of perturbation terms that provide a picture much closer to reality. The FLE is studied with full nonlinearity in the generalized form using Jacobi elliptic functions in this work. It is obtained Jacobi elliptic function solutions and bright, dark and singular optical soliton solutions are also attained with the help of modulus limit of Jacobi elliptic functions for FLE. These solitons appear with constraint conditions on their parameters and they are also presented.

Keywords: Fokas Lenells equation, Optical soliton solutions, Jacobi elliptic functions
Mathematics Subject Classification: 35Q35, 37K45

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Some New Banach Spaces of Double Sequences Derived by Jordan Totient Function

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Abstract: We define new Banach spaces of double sequences derived by Jordan totient function in this work. Moreover, we prove some inclusion relations, examine some topological and algebraic properties, compute the $\alpha-, \beta, (\vartheta)-$ and $\gamma-$ duals of these spaces and finally, we characterize some new 4−dimensional $(4-d)$ matrix classes.

Keywords: Jordan totient function, RH-regular matrix, Matrix domain, Double sequence space.
Mathematics Subject Classification: 40C05, 46A45.

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A Note on the Binomial Double Sequence Spaces

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Abstract: In the current study, the most apparent aspect is to submit new sequence spaces as the domain of 4−dimensional $(4-d)$ binomial matrix. We investigate their topological properties and inclusion relations. In addition, $\alpha-, \beta(bp)-$ and$\gamma-$ duals were determined and finally, some matrix transformations were characterized.

Keywords: $4-d$ binomial matrix, RH-regular matrix, Matrix domain, Double sequence space, Duals, Matrix transformations.
Mathematics Subject Classification: 40C05, 46A45.

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Free transverse vibration of nonhomogeneous and elastically restrained monoclinic rectangular plate by Rayleigh-Ritz method

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Abstract: This paper focuses on a boundary value problem which deals with free transverse vibration of a thin elastic simply-supported nonhomogeneous monoclinic rectangular plate. The plate is elastically restrained against rotation and thickness of the plate is varying in two directions. The Rayleigh-Ritz method with orthogonal polynomials is used in the analysis. The orthogonal polynomials are generated using Gram-Schmidt process. Due to orthogonal polynomials, standard eigenvalue problem is obtained which is solved numerically to obtain the natural frequencies of the plate. The effects of nonhomogeneity parameters, thickness parameters, aspect ratio and flexibility parameters have been studied on the frequencies of the plate. Three dimensional mode shapes have been plotted.

Keywords: Rayleigh-Ritz, restrained, nonhomogeneous, monoclinic.
Mathematics Subject Classification: 70J10, 70J30, 74K20, 74S30, 74-10

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A secure communication Scheme based on adaptive modified projective combination synchronization of fractional-order hyper-chaotic systems

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Abstract: In this work, a novel technique called "adaptive modified projective combination synchronization (AMPCS)" for synchronizing non-identical fractional-order hyper-chaotic systems with unknown parameters has been introduced. The purpose of the suggested technique is to ensure synchronization between two non-identical master systems and one slave system by employing a diagonal matrix, Lyapunov stability theory, adaptive control, adaptive law of parameter, and some techniques of fractional calculus. An application of synchronization in secure communication has been performed. The important feature of the suggested (AMPCS) technique is to create high security in secure communication.

Keywords: Adaptive control, Hyper-chaotic systems, Combination synchronization, Secure communication
Mathematics Subject Classification: 34D06, 37B25, 34A08, 34A34

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CSG: Towards a Comprehensive Model of Growth

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Abstract: The main purpose of this study is to propose a better model than Sloboda and Gompertz models. So, a comprehensive growth model (CSG) is defined by combining Sloboda and Gompertz models, which are well known in literature and properties of the CSG model are given. In order to demonstrate the performance of the proposed model in modeling growth and to compare the performance of the new model with Gompertz and Sloboda models, an application was made on the real data set and the results were presented in table and graphics.

Keywords: Curve Fitting, Gompertz Growth Model, Sigmoid Functions, Sloboda Growth Model.
Mathematics Subject Classification: 91B99, 00A71, 62P99, 91C99

On variational-iterative method for solving of a static beam problem

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Abstract: In the paper, the boundary value problem is solved by the variation-iterative method, which describes the stationary state of a beam. The equation is an equation of the Kirchhoff type [1]. Some computational aspects of this equation and its various modifications are investigated in many works [2-6]. The accuracy of the method is estimated, and its effectiveness is checked by an example.

Keywords:static beam, Galerkin method, iteration method, Newton method
Mathematics Subject Classification: 65H10, 65L10, 65L60, 74K10

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U-net based MRI brain tumor segmentation

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Abstract: In recent years, the implementation of medical information technologies and e-health care framework allows healthcare specialists to provide the patient with quality health care. Brain tumor is one of the primary causes of an increase in human mortality. Segmentation is used to detect contaminated tumor tissues from medical imaging modalities. The U-net is one of the most well-known convolutional neural network (CNN) architectures used for biomedical image segmentation because of the cascade connection in the up-sampling process. It was designed specifically for medical image processing. In this paper, we proposed a U-net based method for brain tumor segmentation. We have applied our approach on 3064 T1-weighted contrast-enhanced images from 233 patients. Data were analyzed in terms of accuracy and IOU-metric. Analysis of the data obtained shows that in accuracy results, on the one hand, training accuracy is greater than validation accuracy. The former is 99.30%, whereas the latter is 99.26%. Similarly, in IOU-metric, on the other hand, validation data (61.52%) are less than training data (64.39%).

Keywords: Image processing, MRI Brain tumor, segmentation, U-net.

Stability analysis of conformable fractional-order nonlinear systems

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Abstract: In this paper, we study the uniformly fractional exponential stability for some class of systems like class of perturbed systems and class of nonlinear fractional-order equations with control using the Lyapunov-like function.

Keywords: Conformable fractional derivative, fractional practical exponential stability.

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Agent Based Modeling and Simulation for Geographic Routing Protocol in the Wireless Sensor Networks

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Abstract: Agent Based Modeling and Simulation (ABMS) is an approach aiming to model autonomous systems and interacting agents. This method is required more and more for its efficiency and its simplicity; it constitutes an interesting issue in the field of the modeling of complex systems. Indeed, ABMS offers, unlike other types of simulations, the possibility of directly representing the simulated entities, their behaviors and their interactions without having to resort to mathematical equations. The obtained models are composed of autonomous interacting agents. Simple rules or processes that are more complicated can describe agent behaviors and interactions. The interactions between the agents society influence the individual and the general behavior of the system. This work is a contribution in this way; the goal is to propose an agent-based model to simulate interacting wireless sensor nodes that manipulate sensed data in order to send it to remote base stations. The proposed approach is validated by a case study of the geographic protocol with avoidance of the minima problem (void problem).

Keywords: Multi-Agent System (MAS), Wireless Sensor Networks, Geographic Routing Protocol, Modeling and Simulation, Void Problem.
Mathematics Subject Classification: General theory of simulation.

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Hybrid Predictive Models for Water Quality Assessment Based on Water Quality Index Using ANN, LSSVM and multivariate statistical Methods

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Abstract: The study and use of water is essential for assessing the quality of surface waters. Several indices have over the years been proposed using s statistical, mathematical, and computational techniques to enhance the understanding of the phenomena that occur in these environments. For this purpose, the variables which influence the quality of the water should be known. Nowadays, indices need to be developed that can address climate change in its variables, making it even more realistic. In this study, multivariate statistical techniques such as PCA are aimed at reduce the number of variables used to recover the costs, laboratory tests and greater representativeness of indices. Searching for improvement and accuracy in indices of water quality, certain computational artificial intelligence techniques, such as LSVM and ANN, are increasingly utilized and achieve expressive research results. These Two machine learning methods have been applied in the current research to investigate and try to emulate WQI's relationship with water quality variables in Cheliff's dam in Mostaganem (Algeria). Moreover, a comprehensive analysis has been performed for the performance assessment and sensitivity analysis of the variables. With high performance accuracy in two used reduced models, the results achieved are promising. The proposed approach also provides an efficient alternative to calculate and predict the WQI by including long computing methods, transformations, the use of various subindex formulas for every value of the water quality component variables and time consumption.

Keywords: Water quality assessment, Computational artificial intelligence techniques, Water quality index, Features selection, PCA, ANN, LSSVM, Algeria.
Mathematics Subject Classification: MSC2020 database: 68Uxx

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Remark on Convergence of the Associated Filters

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Abstract: Let (X, τ) be a topological space. For a proper ideal on (X, τ), the associated filter F_I was defined and investigated in [21]. In this presentation, we shall discuss the convergence of the associated filters in terms of the points which are coming from different types of operator of the ideal topological spaces.

Keywords: Filter, Associated filter, Local function, Hayashi-Samuel space.
Mathematics Subject Classification: 54A20

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Dynamical Modeling and Backstepping Control Applied to the 6-DOF Quadrator UAV

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Abstract: A quadrotor helicopter control includes nonlinearities, uncertainties and external perturbations that should be taken into account in the design of the control laws. In this paper, we present a control strategy based on nonlinear dynamic modeling and backstepping control for an underactuated six-degree of freedom helicopter quadrotor (6 DOF). These quadrotors are very difficult, because in most cases these are nonlinear, multivariate, highly coupled and underactuated systems that should be taken into account when designing control laws. The nonlinear control strategy is based on the Backstepping technique for the two subsystems (translational and rotational). It was justified to select this method through its robustness in terms of the modeling errors and external perturbations. The stability of the closed loop is evaluated by the use of the Lyapunov's theory. The result of the simulation has been successful and demonstrates the efficiency in quasi-stationary flightsand trajectories of the proposed Quadrotor helicopter control strategy.

Keywords: 6 - DOF Quadrotors, Dynamic Modelling, Underactuated Systems, Strongly-coupled, Backstepping control, Theory of Lyapunov
Mathematics Subject Classification: MSC2020 database 93Dxx

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A New AR-ANN-framework for time series Modeling and Identification enhanced using IWO and CMA-ES metaheuristics approaches: A pilot Study

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Abstract: We attempt to design artificial neural networks (ANN) that can help in the automatic identification of the Autoregressive (AR) model. Within classic time series approaches, a time series model can be studied under three groups, namely AR (autoregressive model), MA (moving averages model) and ARMA (autoregressive moving averages model). In this paper, a new AR-ANN scheme applied for times series modeling is presented. It is based on neural networks. This approach will deal with local minima problem of the neuronal networks architecture and simultaneously preserve the fitting quality. The proposed model comprises a parallel interconnection of tow sub-ANN models. The first is primary sub-ARMA-ANN model, which represents an ordinary model with a low resolution for the time series under consideration, the second is an AR-ANN sub-model called the error model, which represents uncertainty in the primary model. Identification is achieved by innovative metaheuristic optimization algorithms such as The invasive weed optimization algorithm (IWO) and covariance matrix adaptation evolution strategy (CMA-ES). The method's effectiveness is evaluated through testing on benchmark function and real signals. In addition, a detailed comparative study with several benchmark methods would make. Intensive computer experimentations confirm that the proposed method can significantly improve convergence and resolution.

Keywords: Time series fitting, ANN, AR, Metaheuristics algorithms.
Mathematics Subject Classification: MSC2010 database: 70E60, 93C85

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An improved ANN-framework for dynamic systems Modeling and Identification using ICA and TLO metaheuristics approaches: A Pilot Study

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Abstract: Neural Network Modeling and Identification of Dynamical Systems presents a new approach on how to obtain the adaptive neural network models for complex systems that are typically found in real-world applications. Neural networks are used in many applications such as image recognition, classification, control and system identification. In this paper, a new hybrid Artificial Neural Network Autoregressive Moving Average (ANNARMA) and Artificial Neural Network Autoregressive (ANNAR) scheme applied for dynamical systems modeling is presented. This approach will deal with local minima problem of the neuronal networks architecture and simultaneously preserve the fitting quality. The proposed model comprises a parallel interconnection of tow sub-ANN models. The first sub-ANN model is the primary model, which represents an ordinary model with a low resolution for the dynamical system under consideration. To overcome resolution quality problem, and obtain a model with higher resolution, we will introduce a second ANN sub model called Error model which will represent a model for the error modelling between the primary model and the real nonlinear dynamic system. Identification is achieved by innovative metaheuristic algorithms such as Imperialistic Competitive Algorithm (ICA) and Teaching–learning-based optimization (TLO). The method's effectiveness is evaluated through testing on the three nonlinear dynamical systems described by Narendra in the literature. In addition, a detailed comparative study with several benchmark methods will be give. Intensive computer experimentations confirm that the proposed approach can significantly improve convergence and resolution.

Keywords: Dynamical systems, Artificial neural network, AR, ARMA, Metaheuristics algorithms.
Mathematics Subject Classification: MSC2010 database: 70E60, 93C85

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Primitive Divisor Theorem and An Application to the Diophantine Equations

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Abstract: One of the powerful tools to solve the Diophantine equations is Primitive Divisor Theorem. In this study we discuss how we can use this tool to solve some exponential Diophantine equations and we give a concrete application of the primitive divisor theorem to a family of exponential Diophantine equations. This theorem enable us to obtain some bounds on the variable of the equation we handle and then we use computer algebra system Maple to complete the solution of equations

Keywords: Primitive Divisor Theorem, Diophantine equations
Mathematics Subject Classification: 11D61, 11Y55

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A CAD System for breast cancer diagnosis using TAR calculation

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Abstract: Breast cancer is the most feared cause of death in woman worldwide. There were more than 2.3 million new cases and 685 000 deaths across the world in 2020 according to the World Health Organization. In the last few decades mammography become the most efficient radiological technique and mostly used. To help radiologists in the process of detection and diagnosis, Computer Aided Diagnosis systems (CADx) using digital mammograms and computer vision techniques represent a powerful tool to insure double reading of image screening. In addition of segmentation and classification, specific descriptors are the key of an effective CADx systems. Many descriptors have been developed but automatic diagnosis still a very hard task due to the fact that breast masses vary in shape and size which make their description difficult. In this research we proposed a novel descriptor based on triangle-are representation (TAR) calculation. Spiculations are the most significant features used to discriminate malignant and benign masses main. TAR descriptor browses all the point of contour's mass, detect and measure the convexity/concavity of each pixel with different steps. CBIS-DDSM dataset is used to perform training and testing with Fuzzy C-Means classifier. Experimentation results shows that accuracy of correct classification was 82.80

Keywords: Breast Cancer, CADx system, mammography, CBIS-DDSM, Shape description, Triangle-area Representation

Stability of Riemann-Liouville fractional-order delay nonlinear systems

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Abstract: Various processes with anomalous dynamics in science and engineering can be formulated mathematically using fractional differential operators ([1]). When the Riemann-Liouville (RL) fractional derivative is applied in differential equations the statement of initial conditions is very important. Fractional differential equations in terms of the RL derivative require initial conditions expressed in terms of initial values of fractional derivatives of the unknown function ([2]). In the case of zero initial conditions the RL, Grunwald-Letnikov (GL) and Caputo fractional derivatives coincide ([2]). For this reason, some authors either study Caputo derivatives, or use RL derivatives but avoid the problem of initial values of fractional derivatives by treating only the case of zero initial conditions. This leads to the consideration of mathematical correct problems, but without taking into account the physical nature of the described process. Sometimes, such as in the case of impulse response, nonzero initial conditions appear (see, for example, [2]). In connection with the main idea of stability properties we will consider in this talk nonzero initial conditions for RL fractional equations and we will define in an appropriate way stability properties which are slightly different than those for Caputo fractional differential equations. More detailed, in this talk the initial value problem for nonlinear delay differential equations with the RL fractional derivative is studied. Based on the arguments in the book [2], we set up initial conditions expressed in terms of initial values of fractional derivatives of the unknown function. Any solution of the defined initial conditions with RL fractional derivatives is not continuous at zero (the initial point). We require a new definition for stability excluding a small interval around zero. We define stability in time and generalize Mittag-Leffler stability in time for RL fractional differential equations. The stability properties of the zero solution are studied by Lyapunov functions. An appropriate modification of the Razumikhin method is suggested. Two types of derivatives of Lyapunov functions are applied: the RL fractional derivative when the argument of the Lyapunov function is a solution of the studied problem and the Dini fractional derivative among the studied problem.

Keywords: Riemann-Liouville fractional derivative, time-varying delay, stability, Lyapunov functions, fractional derivatives of Lyapunov functions, Razumikhin method
Mathematics Subject Classification: 34A08, 34K37, 34K20

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Coefficients of singularities for boundary value problems governed by the Lamé (elasticity) system in a plane sector

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Abstract: This paper represents the solution to boundary value problems governed by the Lame (elasticity) system in a plane sector. By using appropriate Betti function, we establish a biorthogonality relation between the terms of the series, which allow us to calculate the coefficients of singularities in the important case crack.

Keywords: Lamé system, Crack, Singularity, Sector.
Mathematics Subject Classification: 35B40, 35B65, 35C20

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Generalized memory and fractional calculus: A point of view

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Abstract: Fractional calculus deals with the study of so-called fractional order integral and derivative operators over real or complex domains, and their applications. In this talk I will present some new results regarding the generalised memory and fractional calculus. A new physical meaning of fractional operators will be presented.

Keywords: fractional calculus, physical meaning, generalized memory, extended kernels.
Mathematics Subject Classification: 34A08

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Evolution Problem with prox-regular nonconvex constraint sets

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Abstract: In this work we discuss the evolution problem known as differential inclusion for a class of prox-regular non-convex sets. An existence result of the evolution problem is proved in the finite dimentional setting. Assuming that such sets depend both on the time and on the state.

Keywords: Evolution problem, differential inclusion, prox-regular sets.
Mathematics Subject Classification: 34G20. 49J52. 70H03

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A Dynamical Study of Fractional Order Obesity Model by a Combined Legendre Wavelet Method

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Abstract: We have a new compartmental fractional order model for the simulation of epidemic obesity dynamics. Using the Legendre Wavelet method combined with the decoupling and quasi-linearization technique, we demonstrate the validity and applicability of our model. We also present a new compartmental ordinary order model for the complication of obesity. We will present some fractional differential illustrative example to demonstrate the applicability and efficiency of the method via Matlab.

Keywords: Obesity, Epidemiology, Fractional derivative, Legendre wavelet method.

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Crack Propagation in Hollow Battery Electrode Particles using Bond Based Peridynamic Theory

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Abstract: Battery electrode particles suffer from diffusion induced stresses causing failure and capacity fading during lithiation and delithiation. The diffusion problem in a hollow cylindrical electrode particle is modeled using 2-d finite element method (FEM) considering critical lithiation/delithiation cases. The diffusion equation is solved by FEM utilizing Crank-Nicolson scheme for time discretization [1]. Bond based peridynamic model [2] is utilized for the elasticity problem with diffusion coupling using the obtained lithium concentration distribution from FEM analysis. Fracture of brittle solids under thermal shock is modeled using peridynamic theory can be found in the literature [3,4]. In this work, linear elastic fracture behavior of hollow cylindrical/spherical cathode electrode particles will be investigated, and a comparison will be presented for the available experimental works [5].

Keywords: Peridynamics, Diffusion-Stress, Electrode Particles.
Mathematics Subject Classification: 1X234

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Some Results for Kantorovich Type Bivariate Linear Positive Operators

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Abstract: In mathematics, some functions can not be used directly in many problems because of their complex forms. Therefore, they are approximated by elementary functions as much as possible. This makes it possible to investigate the problem, readily. One of the important aspects of the theory of approximation is linear positive operators. With the proof of the theorem due to Weierstrass [1] and the fundamental convergence theorem given by Korovkin [2], various new operators have been established and their approximation properties have been examined from many different perspectives by several researchers. The talk will be centered about bivariate Bernstein-Beta Kantorovich type operators constructed by a transformation formula for the Pochhammer symbol [3]. We investigate the degree of approximation of the bivariate operators via complete and partial modulus of continuity and also we obtain Voronovskaja type theorem. Furthermore, we present some graphical examples to compare the approximation process between our modified bivariate operators and some other familiar linear positive operators.
Keywords: Lipschitz Class, Modulus of Continuity, Voronovskaja Type Theorem.
Mathematics Subject Classification: 26A16, 41A10, 41A25, 41A36

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Rational Proper Holomorphic Mappings from $\mathbb{B}^n$ into $\mathbb{B}^{3n-2}$

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Abstract: This talk is based on a joint work with Shanyu Ji and Wanke Yin. We study proper rational holomorphic maps between the complex unit balls $\mathbb{B}^n$ and $\mathbb{B}^N$, and denote by $Rat(\mathbb{B}^n, \mathbb{B}^N)$ the set of all such maps. By Caylay transformation, we can identify $\mathbb{B}^n$ with the Siegel upper half space $\mathbb{H}_n$. In this talk, we characterized rational proper holomorphic maps from $\mathbb{B}^n$ into $\mathbb{B}^{3n-2}$.

Keywords: Rational holomorphic maps between balls, proper holomorphic maps
Mathematics Subject Classification: 32A10

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A Note on Projective Transformation on Riemannian and Non-Riemannian Manifolds

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Abstract: The construction of the projective transformation for the Weyl manifold which is admitting a newly constructed connection is shown in a detailed manner. Also, its unique identities concerning local coordinates, are proven. In addition to all, the differences and similarities between Riemannian, Weyl, and newly constructed Weyl manifolds' projective transformations are represented to evaluate the geometric structures of manifolds.

Keywords: Riemannian Manifolds, Non-Riemannian Manifolds, Weyl Manifolds, Projective Transformation, Semi-Symmetric Metric Connection.
Mathematics Subject Classification: 53A35, 53B20, 53C25

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Stabilization and hybrid synchronization via the adaptive control method of 4-D financial hyper-chaotic systems

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Abstract: In this work, we have considered the stabilization and the hybrid synchronization by the adaptive control method for two non-identical 4-D financial hyper-chaotic systems with unknown parameters, based on Lyapunov's stability theory and the theory of adaptive control. We derive new control results via adaptive control method based on Lyapunov stability theory and adaptive control theory for globally synchronizing two non-identical 4-D financial hyper-chaotic systems with unknown system parameters. The results are validated by numerical simulation using Matlab.

Keywords: hyper-chaotic system, Lyapunov exponent, stabilization, synchronization.
Mathematics Subject Classification: 34C28, 34D08, 37D45, 93C40, 93D05.

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Ab-initio calculation on optoelectronic properties of BeGeP2 for tandem solar cells applications

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Abstract: Recently, II-IV-V2 ternaries have received much concentration due to their valuables properties using in potential applications in optoelectronics, nonlinear optic, and photovoltaic absorber material in solar cells. The main aspects of interest for a material to be used in optoelectronic: emission of light and photovoltaic effect. The optoelectronic properties of BeGeP2 ternary have been theoretically calculated and investigated from the ab-initio approach by using the density functional theory within the FP-LAPW method integrated into the Wien2k code. Our calculations within the TB-mBJ approach indicate optimal bandgap energy and a very high optical absorption coefficient above 105 cm-1, making this compound suitable for solar cell absorbers.

Keywords: DFT, ab-initio calculation, properties modeling, Schrödinger equation.

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Characteristic Analysis for a Fractional-order Converter in Continuous Conduction Mode

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In the present work, a comparative study between a fractional-order DC-DC boost converter and an integer one operating in continuous conduction mode is put forward. By using the fractional definition of Riemann-Liouville, the state average model of the fractional order boost converter is presented. Since there are currently no commercial fractional components such as inductor and capacitor, the constructed model of the fractional converter is derived based on Oustaloup Recursive Approximation Method (ORAM). The approximate circuit is simulated and is compared using MATLAB/ Simulink. The results show that the inductor and the capacitor orders are considered as extra parameters, so that the capacitor voltage and the inductor current as well as their ripples are all influenced by the fractional order. Consequently, the feasible simulations confirm that the model derived under fractional calculus has more freedom and elasticity for converter applications.

Keywords: DC-DC boost converter, Fractional calculus, Oustaloup Recursive Approximation.
Mathematics Subject Classification: 00A71, 26A33, 30E10.

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A 3-step block hybrid backward differentiation formulae (BHBDF) for the solution of general second order ordinary differential equation

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Abstract: In this paper, the block hybrid Backward Differentiation formulae (BHBDF) for the step number k=3 was developed using power series as basis function for the solution of general second order ordinary differential equation. The idea of interpolation and collocation of the power series at some selected grid and off- grid points gave rise to continuous schemes which were further evaluated at those points to produce discrete schemes combined together to form block methods. Numerical problems were solved with the proposed methods and were found to perform effectively.

Keywords: Block, Hybrid, Backward differentiation formulae, Ordinary differential equation.
Mathematics Subject Classification: 65L05, 65L06

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Non-Instantaneous Impulsive Fractional Differential Equations: A Rigorous Survey

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Abstract: Non-instantaneous impulsive fractional differential equations can be used to model dynamic processes which have a memory effect (fractional) and are subject to external influences (impulses) which occur over non-negligible periods of time (non-instantaneous). A few different methods have been applied in the literature to rewrite differential equations in the form of equivalent integral equations. However, due to some special considerations arising only in the non-instantaneous impulsive fractional setting, these methods do not always apply in this setting, although many papers in the literature have applied them anyway, without noticing these special considerations and subtleties. We survey the various methods available, checking carefully to see whether each one can truly be applied or not, and demonstrate a correct approach for each of two different possible formulations of non-instantaneous impulsive fractional differential equations.

Keywords: fractional differential equations, impulsive differential equations, non-instantaneous impulses, fractional integrals.
Mathematics Subject Classification: 34A37, 34A08, 26A33.

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The SOR iterative method for new preconditioned linear algebraic systems

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Abstract: Over the years, a good number of preconditioners have been introduced to improve the convergence of iterative methods for solving linear systems. A common feature of most of these preconditioners is that the preconditioning effect is restricted to only certain entries of the coefficient matrix. In an effort to address this drawback, a new preconditioner is proposed; the effect of its application is observed on every entry of the coefficient matrix; in particular, the preconditioner eliminates the last entry on the leftmost column and scales down every other entry. Convergence and comparison theorems of the resulting preconditioned iteration technique are advanced and established. Simulated solutions of sample numerical examples via Maple 2019 Computer Algebra System are presented. It reveals that the proposed method converges faster than the SOR as well as other preconditioned iterations in literature.

Keywords: Successive overrelaxation (SOR), Convergence, Preconditioning, Spectral radius, Iterative Matrix.
Mathematics Subject Classification: 65F10

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On the Exact Solutions of Wick Type Stochastic Boussinesq Equation

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Abstract: In this study we consider the Wick type stochastic Boussinesq equation with variable coefficients driven by a white noise is undertaken. The exact solutions of a Wick-type Boussineaq equation have been obtained by using the Hermite transform and the sub-equation method. By taking the Hermite transform of the Wick-type stochastic evolution equation allows to turn the Wick products into an ordinary one. After then, the inverse Hermite transform have been applied to obtain the stochastic solution in the white noise space.

Keywords: *Hermite transform, Wick product, Boussinesq* equation

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Non-integer derivatives in selected areas of physics

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Abstract: The talk will be about the non-integer (fractional) derivative, its mathematical formulation by Abel in 1823, and present day applications in modeling power-law behavior. These applications are in acoustics of complex media like tissue and sediments as well as in rheology, turbulence, and dielectrics. It will build on my book "Waves with Power-Law Attenuation", Springer, 2019.

Keywords: fractional calculus, physics, acoustics

Denoising of degraded facial image sequences based PCA

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Abstract: One of the most stringent issues in image sequence processing lies in the high dimensionality of the image sequences. This issue is further made worse by the high correlation between the frames, on the one hand, and by the difficulty of noisy motion estimation, on the other hand. As a result, the de-noising algorithms are complex and require intense computational workload. To address this issue, we propose a novel algorithm based on the Principal Components Analysis (PCA) for dimension reduction, followed by a spatiotemporal filter for de-noising the dimensionally-reduced frames.
The de-noising process is performed in the image reduced space by applying a temporal filter for motion compensation combined with a weighted average filter, and an anisotropic diffusion filter as a spatial filter to remove the noise. The performance of the proposed method is proven using the Cohen-Canade facial expressions (CKFE) database tested against different noise levels with PSNR and UIQ as metrics for objective evaluation. The experiments show that the proposed method gives better results than state-of-the-art classical de-noising competitors.

Keywords: Image denoising, Spatiotemporal filter, anisotropic diffusion filter ,PCA.
Mathematics Subject Classification: 68U05, 68U10, 68T05, 68T10.

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On Lah-Ribarič inequality for (h, g; m)-covex functions

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Abstract: We study a new class of (h, g; m)-convex functions that unifies a certain range of convexity and allows the generalizations of know results. For this class we present Lah-Ribarič type inequalities from which we obtain inequalities of Hermite-Hadamard, Fejér, Giaccardi, Popoviciu and Petrović.

Keywords: Convex function, Lah-Ribarič inequality, Giaccardi inequality.
Mathematics Subject Classification: 26A51, 26D15

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Modelling and Analysis of Proteins Aggregation in Neurodegenerative Diseases

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Abstract: Protein aggregation leading to the formation of amyloid fibrils is involved in several neurodegenerative diseases such as Alzheimer's disease, Parkinson's disease, and prion diseases. However, these mechanisms of the fibrils aggregation are still misunderstood by the specialists, and, for the most part, hypothetical only.
To clarify how these fibrils are able to incorporate additional units, prion fibril aggregation and disaggregation kinetics were experimentally studied.
An initial model, adapted from the Becker-Döring system is considered, and compared to the experimental data. Aiming to reproduce the observed in vitro behaviour.
Our second model involves an additional compartment of fibrils unable to incorporate more prion units. This model leads to kinetic coefficients which are biologically plausible and correctly simulates the first experimental steps for prion aggregation.

Keywords: Mathematical Modelling ; Simulation ; Data Fitting ; Numerical Analysis ; Parameter Estimation ; Prion Diseases ; Prion aggregation
Mathematics Subject Classification:

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The Flux, Energy and Heating Calculations for Reactor Core Designed with Monte Carlo Modelling

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Abstract: In this study, a boiling water reactor (BWR) core modeling was performed using the Monte Carlo mathematical modelling (MCNPX-2.7.0 code and ENDF/B-VII library). In the modeling, an 8x8 square lattice was designed for the reactor core. In the designed square lattice; 0.65-0.7-0.75% NpO_2 and NpF_4 were used as fuel rod, Zr-2 and SiC for fuel cladding, water as coolant and B_4C as control rod. In this study, neutron flux, fission energy and heating neutronic values were calculated for the selected fuel and clad in the designed BWR.

Keywords: MCNPX-2.7.0, flux, heating

Investigation of Some Neutronic Calculations for Vanadium Carbide Cladding Material in a Boiling Water Reactor Modelling

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Abstract: In this study, a boiling water reactor was modelled and Vanadium Carbide (VC) was used as cladding material in the design. In the designed reactor core, small squares lattices were placed in square lattices. Neptunium mixed fuel rod, VC cladding material, water cooler were used in each small square lattice. NpO_2 and NpF_4 fuels were used as the Neptunium mixture in the fuel rods. In this study, the criticality (k_{eff}), neutron flux, fission energy, heating and deposition values were investigated for the VC cladding material. In the research, the reactor design was made in three dimensions using MCNPX-2.7.0 Monre Carlo code and ENDF/B-VII library.

Keywords: k_{eff}, MCNPX-2.7.0, cladding material.
Mathematics Subject Classification:

Upshot of Marangoni nanofluid thin film flow under the influence of an inclined magnetic field

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Abstract: A numerical simulation is conducted for the applied inclined magnetic field on a two dimensional electrically conducting unsteady Marangoni nanofluid thin-film flow past a horizontal extending sheet. The composite of nanofluid comprises Copper nanoparticles and kerosene oil base fluid. The envisioned flow is also affected by the non-uniform source/sink and viscous dissipation. The succor of the Shooting technique amalgamated with the Fehlberg Runge-Kutta computational scheme is secured for the solution of a highly nonlinear system of equations. The significant impacts of the prominent arising parameters versus involved fields are examined through graphs. The outcomes show that the fluid velocity of the thin film nanofluid flow is curbed for a strong magnetic field nevertheless an opposing trend is witnessed in case of the liquid temperature. Furthermore, the rate of heat flux is escalated versus estimates of nanoparticle volume fraction and time-dependent parameter.

Keywords: Marangoni effect, Nanofluid thin film flow; Numerical solution; Non-uniform source/sink.
Mathematics Subject Classification: 76D05, 76Dxx

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Some convergence results for generalized $\alpha-$nonexpansive mapping in Banach Spaces

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Abstract: In this paper, we introduce a new iterative scheme to approximate fixed point of generalized $\alpha-$nonexpansive mappings. We also prove weak and strong convergence theorems for generalized $\alpha-$nonexpansive mappings by using new iteration process. At the end, we give an example for generalized $\alpha-$nonexpansive mappings and compare the convergence behavior of new iterative process with other iterative processes.

Keywords: Generalized $\alpha-$nonexpansive mappings, iteration process, fixed point, convergence
Mathematics Subject Classification: 47H09; 47H10

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Qualitative analyses of systems of integro –differential equations with time-delay retardation

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Abstract: A mathematical model consisting of a system of nonlinear IDDEs with constant time retardation was taken into account. We give three new results such that they are related to uniformly asymptotically stability of zero solution as well as square integrability of norm of solutions and boundedness of solutions. The approach used in the proofs depends upon the construction a more new suitable LKF and use it in the proofs. Two examples are provided to illustrate the applications of the results. Compared to qualitative results in the literature related to the IDDEs, our results do new contributions to theory of integro-differential equations and the related results.

Keywords: System of nonlinear integro-differential equations, constant time delay, stability, integrability, boundedness, Lyapunov – Krasovskiĭ functional
Mathematics Subject Classification: 34K05, 34K12 34K20

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Generalized solution of a nonlinear optimal control of the heel angle of a rocket

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Abstract: We use some recent developments in Dynamics Programming Method [2,3] to obtain a rigorous solution of the optimal control problem formulated in [5] as an unsolved problem, and studied partially in [1] We use a certain refinement of Cauchy's Method of characteristics for stratified Hamilton-Jacobi equations to describe a large set of admissible trajectories and to identify a domain on which the value function exists and is generated by a certain admissible control and, its optimality is justified by the use of one of the well-known verification theorems as an argument for sufficient optimality conditions.

Keywords: Optimal control, differential inclusion, Pontryagin's maximum principle, dynamic programming, Hamiltonian flow.
Mathematics Subject Classification: 49J15, 49L20, 34A60.

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Some thoughts on differential operators for certain subclass of analytic functions

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Abstract: This article discusses on differential operators for certain class of analytic functions. Many differential operators have been introduced in a very creative way. The most basic ones can be traced back in 1975 by Ruscheweyh[1] and later by Salagean [2]in 1985. Then in 2000 onwards, we can see the generalisation of Salagean by Al-Oboudi[3] and generaiisation of Salagean and Ruscheweyh by Darus and Al-Shaqsi [4]. Afterwards, many similar ones can be seen in various platforms of publications. It become more robust when q-analogue was imposed on the differential operators (see eg. [5]). Here, some earlier works will be traced back and some recent results will be presented.

Keywords: Analytic functions, differential operator, q-analoque
Mathematics Subject Classification: 30C45

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Riemann conjecture for the Riemann zeta function

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Abstract: In this report we present two approaches for the detailed proof for the Riemann conjecture for the Riemann zeta function.

Keywords: Riemann zeta function, Riemann conjecture, critical line, nontrivial zeros.
Mathematics Subject Classification: 11M06, 11M26

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Energy uniform decay rates for the semi-linear wave equation with nonlinear localized damping and source terms of critical variable exponent

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Abstract: The goal of this paper is to consider a model of a semilinear wave equation with critical source term $f(u(x,t))$ and a localized exterior nonlinear monotone damping $g(u_t(x,t))$. The proposed approach allows considering, in a unified way, much more general classes of hyperbolic problems than addressed before in the literature. This generalization refers to an analysis aspect of the problem. The method leads to optimal decay rates for solutions of semilinear hyperbolic equations driven by a source of critical variable exponent and subjected to nonlinear damping localized in a small region adjacent to a portion of the boundary. The no-growth condition is imposed on the damping $g(u_t(x,t))$, and this is the distinct feature of the model include. Hence we consider a more general case of g, and the sole conditions assumed are, g has not a polynomial behavior near the origin, monotonicity, continuity, and $g(0) = 0$. In particular, no differentiability and no growth conditions are imposed on the damping both at the origin and at the infinity. The asymptotic decay rates for the energy function obtained by using Martinez's method [11], however, this paper can be regarded as a generalization of Martinez's results.

Keywords: Wave equation localized damping, source, decay rates, critical exponents, variable nonlinearity.
Mathematics Subject Classification: 35L05, 35B40, 35A01

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Navigation in Multi-Robot Systems Based on the Behavioural Fuzzy Controller

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Abstract: Controlling a highly dynamic multi-robot system (DMRS) is a challenge scientific and technological in constant expansion. This article focuses on navigation in DMRS. In this context, the navigation methods allow the robot to move from a start point to target point while avoiding obstacles. These methods must therefore take into account the following problems: Fixed Obstacle Avoidance Problem (FOAP); Mobile Obstacle Avoidance Problem (MOAP) and Robots Collision Avoidance Problem (RCAP). In the FOA Problem, the environment is considered static and contains a single robot. In the MOA Problem, the environment contains dynamic obstacles and several robots. In this case, each robot move in the environment without communication, and the robots are considered obstacles to each other. Finally, in the RCA Problem, robots could communicate with each other to find an arrangement to avoid collisions between them.
The proposed navigation method in DMRS allows the robot to move from a starting point to a target point while avoiding obstacles. Local interactions between robots are used to produce a form of advanced collective intelligence. Using the concept of fuzzy logic, reactive control is modeled to allow mobile robots to move in an unknown environment. The model must also guarantee the resolution of conflicts to determine the priority-of-way when two or more robots are on the same crossing point. The simulation results obtained on the pioneer P3-DX robot clearly show the efficiency of the proposed architecture.

Keywords: Mobile Robots, Navigation, Fuzzy logic, behavioral controller architecture, collective intelligence, Multi-robot systems.
Mathematics Subject Classification:

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Mathematical modelling of the denitrification process

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Abstract: A mathematical model of nitrate removal in woodchip denitrification bioreactor was developed. The model based on a system of two nonlinear differential equations was used for the analysis of the water treatment process. Using computer simulation, the influence of the length of the bioreactor as well the diffusion and pore-water velocity on the nitrate concentration was investigated. The computer simulation was carried out using finite difference technique.

Keywords: Mathematical modeling, Differential equations, Reaction-diffusion, Bioreactor, Denitrification
Mathematics Subject Classification: 35Q92, 65M06

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Semilocal Convergence of a Family of Ehrlich-type Iterative Methods

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Abstract: One of the famous third-order iterative method for finding simultaneously all the zeros of a polynomial was introduced by Ehrlich [2] in 1967. In this study, we construct a new family of high-order iterative methods as a combination of Ehrlich's iteration function and an arbitrary iteration function. We call these methods *Ehrlich's methods with correction*. We present a semilocal convergence theorem (with computer verifiable initial condition) of presented iterative methods for a large class of iteration functions. The proof of our result is based on the results presented in [2] and [3]. As special cases of the main result, we study the semilocal convergence of Ehrlich's method with Newton's correction (Nourein's method [4]), Ehrlich's method with Weierstrass' correction, and Ehrlich's method with Halley's correction. The main result extends the recent results of the authors [5] on the semilocal convergence of Nourein's method. We end the talk with some numerical examples to show the applicability of our results.

Keywords: Iterative methods, Polynomial zeros, Ehrlich method, Semilocal convergence
Mathematics Subject Classification: 65H04

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Local Convergence of a Family of Multi-Point Ehrlich-type Root-Finding Methods

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Abstract: This talk deals with multi-point iterative methods for finding all zeros of a polynomial simultaneously. In 1999, Trićković and Petković [1] constructed a two-point variant of the well-known Ehrlich's method [2]. They proved that the order of convergence of the two-point Ehrlich-type method is $1 + \sqrt{2}$. In this study, we construct an infinite sequence of multi-point Ehrlich-type iterative methods. The first member of this family of iterative methods is the two-point Ehrlich-type method introduced in [1].
The purpose of the talk is to present a local convergence theorem for the multi-point Ehrlich-type methods. The obtained result gives a convergence domain, a priori and a posteriori error estimates, and order of convergence of each method of the family. In particular, we prove that the order of convergence $r = r(N)$ of the N-th multipoint iterative method ($N = 1, 2, \ldots$) is the unique positive root of the equation

$$1 + 2(t + \ldots + t^N) = t^{N+1}.$$

Therefore, for the first iterative method ($N = 1$) of the family, we obtain the order of convergence $r = 1 + \sqrt{2}$ which coincides with above mentioned result of Trićković and Petković. Our local convergence theorem is obtained by an approach introduced in [3].

Keywords: Iterative methods, Polynomial zeros, Local convergence, Error estimates
Mathematics Subject Classification: 65H04

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Tensorial total variation based image and video restoration with optimized projection methods

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Abstract: The total variation regularization method was introduced by Rudin, Osher, and Fatemi as an efficient technique for regularizing grayscale images. In this work, we aimed to generalize the total variation method to regularize multi-dimensional problems such as color image and video restoration. A degradation model in a tensor format is proposed to recover blurred and noisy color images and videos.
The alternating direction method for multipliers (ADMM) and an optimized form of projection methods have been employed to solve the tensorial total variation minimization problem.
The structure of the developed approach allows the selection of optimal parameters. We use the TSVD to reduce the size of the problem and to accelerate the convergence of the algorithm. The convergence analysis of the proposed method is proved using convex optimization. Numerical tests for image and video restoration are given showing the effectiveness of the proposed approaches.

Keywords: Tensorial algebra, total variation, ADMM, Shrinkage formula, projection methods, discrepancy principle.
Mathematics Subject Classification: 15A69, 65K10.

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Color image and video restoration using tensor CP decomposition.

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Abstract: This paper proposes a new approach to image and video restoration. This approach is based on tensor representation to construct the degradation model, in which a color image is represented by a third-order tensor and a video comprised of color images is a fourth-order. Applying tensor CP decomposition, which is a low-rank decomposition, to our original problem leads to three subproblems. To solve those subproblems, we apply Global LSQR algorithm and a new algorithm based on Golub Kahan bidiagonalization. Some numerical tests are presented to show the effectiveness of the proposed methods.

Keywords: CP decomposition, Color image restoration, video restoration, LSQR.
Mathematics Subject Classification: 1X234

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Performance of the Liu-type estimator in the Bell regression model

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Abstract: Poisson regression is generally used in which the response variable comes in the form of observed data. But, the major drawback of the Poisson regression model is the equidispersion assumption, where the variance of the model is restricted to be equal to its mean. In many real-life problems, this assumption does not hold. When the variance is greater than the mean, this problem is called an overdispersion problem. Alternative models can be used to model overdispersed data, such as the negative binomial regression model (NBRM). Castellares et al. (2018) proposed the Bell regression model (BRM) to cope with the overdispersion problem. The main advantage of the BRM to the NBRM is that the BRM has only one parameter. Another problem seen in data is the multicollinearity problem which occurs among the explanatory variables. Amin et al. (2021) defined the Ridge estimator in the BRM to simultaneously solve the overdispersion and multicollinearity problems. After this work, Bulut and Işılar (2021) proposed the Liu estimator in the BRM. In this study, we introduce the Liu-type estimator, defined by Liu (2003), in the BRM. Also, we give a small simulation study to illustrate the superiority of the proposed estimator over the Ridge and Liu estimators.

Keywords: Bell regression model, Liu-type estimator, overdispersion
Mathematics Subject Classification: 62J07, 62J12

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The fluid limit of the processor sharing multi-class multi-queue

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Abstract: We present a tandem network of finite sequence of queues, each one has a single server with several classes of customers, arbitrary interarrival and service time distributions. Upon completing service, customers may leave, or reenter the same queue, possibly as customers of a different class or forwarding to some class of the next queues. The server is operating under the egalitarian processor sharing discipline. When this system has a critical data and under slightly more restrictive assumptions on initial state, we show the existence and uniqueness of the fluid solution. For asymptotic behavior, under mild assumptions of initial state, we describe the behavior of solutions as time approaches infinity.

Keywords: Fluid limit, Fluid model, Queueing Networks, Multiclass networks, Multi-station, Processor sharing.
Mathematics Subject Classification: 60K25

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An Optimal Energy Control For a Serially Connected Euler-Bernoulli Beam

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Abstract: A system of a serially connected Euler-Bernoulli beam and its optimal energy control are studied by means of semigroup of linear operators in the present paper. The system is formulated by partial differential equations with the boundary conditions. The spectral analysis and semigroup generation of the system are discussed in the appropriate Hilbert spaces. Finally, an optimal energy control is proposed, and existence and uniqueness of the optimal control are demonstrated. Eventually, an approximation theorem is proved in terms of semigroup approach and geometric method.

Keywords: Serially Connected Euler-Bernoulli Beam, Optimal Energy Control, Semigroup of Linear Operators
Mathematics Subject Classification: 35B35, 93C20

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On Λ-Fractional Differential Geometry

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Abstract: Applying a new Fractional derivative, the Λ- Fractional Derivative, with the corresponding Λ-Fractional space, Fractional Differential Geometry is discussed. The Λ-Fractional derivative satisfies the conditions for the existence of a differential, demanded by the Differential Topology, in the Λ-fractional space, where the Λ-derivatives behave like the conventional ones. Therefore Fractional Differential Geometry is established in that Λ-space in a conventional way. The results are pulled back to the initial space. The present work concerns the geometry of fractional curves and surfaces.

Keywords: Λ-Fractional Derivative, Λ-Fractional space, Λ-Fractional Differential Geometry, Λ- Fractional Tangent, Λ-Fractional Curvature, Λ-fractional tangent space of surfaces.
Mathematics Subject Classification: 53Z05

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Majorization Features For Analytic Functions Involving A Linear Operator

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Abstract: The first studies of majorization in univalent functions has been investigated by MacGregor in 1967. Later, several researchers studied majorization problems for univalent and multivalent functions, which are subordinate to the functions having positive real part, involving various different operators. In this paper, we define a new subclass of Ma-Minda type function class by using Carlson-Shaffer linear operator and cosine hyperbolic function. We introduce majorization properties for this function class. Moreover, some corollaries for this function class are presented.

Keywords: Analytic function, Carlson-Shaffer linear operator, Majorization, Uniformly starlike functions
Mathematics Subject Classification: 30C45, 30C50

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A Data-Driven Machine Learning Algorithm for Financial Market Prediction

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Abstract: A machine learning algorithm, that is based on Gabor transform (spectrogram) and singular value decomposition, is built to classify and predict financial market trends. The reliability of the classifier is demonstrated by randomly generated time series, and effectiveness of the trend prediction algorithm is examined by the practical implementation of the NASDAQ-100 stock markets. It is manifested that price pattern of stock markets can be recognized and trend of the considered stock markets can be predicted effectively via the developed algorithm.

Keywords: Stock market prediction, Machine learning , Pattern recognition, Data-driven methods
Mathematics Subject Classification: 68Q32, 62P05, 91G15

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Application of machine learning techniques for predicting the WQI for water quality monitoring: a case study in Algeria

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Abstract: Surveillance of surface water quality is a major environmental challenge. The Water Quality Index (WQI) describes a number of water quality variables at a certain location environment and time. WQI is usually calculated by traditional methods involving long-term calculation, a timing consumption, and accidental errors occasionally associated with subindex calculation. Thus, it is highly necessary to provide an accurate WQI prediction model. Recently, similar prediction applications were explored in artificial neural networks (ANNs) and the capability to capture the pattern of nonlinearity between forecast and prediction is remarkable. Two machine learning methods have been applied in the current research: ANFIS and SVM models to investigate and try to emulate WQI's relationship with water quality variables in Cheliff's dam in Mostaganem (Algeria). Moreover, a comprehensive analysis has been performed for the performance assessment and sensitivity analysis of the variables. With high performance accuracy in two used models, the results achieved are promising. The proposed approach also provides an efficient alternative to calculate and predict the WQI by including long computing methods, transformations, the use of various subindex formulas for every value of the water quality component variables and time consumption.

Keywords: Water quality prediction, supervised machine learning, water quality index (WQI), ANFIS, SVM, Algeria.
Mathematics Subject Classification: 68Uxx

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A new implementation of the Block QMR method for solving non-symmetric systems of linear equations with multiple right-hand sides

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Abstract: The block QMR is a block Krylov solver for solving non-symmetric systems of linear equations with multiple right-hand sides. This method is classically implemented by first applying the Lanczos iteration as a block biorthogonalization process to create two bases. The first one is of the block Krylov subspace generated by the matrix of the system from the initial residual and the second one is of the block Krylov subspace generated by the matrix transpose of the system from the initial residual. Next, the method is solving a block least-squares problem, which is equivalent to solving several least-squares problems implying the same tridiagonal matrix. These latter are usually solved by using a block updating procedure for the QR decomposition based on givens rotations or the Housholder decomposition of the tridiagonal matrix like in the Bl-GMRES. In this work, we develop a new block version of the QMR method by using a simple implementation, based on a particular partitioning of the tridiagonale matrix given by the Lanczos iteration as a block biorthogonalization process.

Keywords: Linear system, Krylov subspace method, projector, pseudo-inverse.
Mathematics Subject Classification: 65F10, 65F20, 65F50, 65L20

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The magnetic dipole effect framework on the thixotropic nanofluid flow past the continuous curved stretched surface

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Abstract: The magnetic dipole influence of a thixotropic nanofluid with heat and mass transfer as well as the concentration of microorganisms past the curved sheet is investigated. The dynamic problem model is converted to non-linear ordinary differential equations through similarity transformations, which are resolved by an efficient and robust method, i.e. the homotopy analysis method. The solution is evaluated on the basis of all built-in parameters. The velocity is reduced by the dipole influence while it is increased by the thixotropic nanofluid parameter. The temperature increases with the dipole effect and the concentration increases with the increase of the curvature parameter and the density of the motile microorganisms decreases with the Peclet number. Streamlines show that trapping on the curved stretched surface is uniform.

Keywords: curved stretching sheet, electromagnetism, Heat convective conditions, porous medium, radiation, thixotropic ferrofluid.
Mathematics Subject Classification: 35Q35,76D05, 80A20

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Further Properties of L-closed topological spaces

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Abstract: In this research, we focus on some properties of almost, weakly and nearly L-closed topological spaces. We proposed lots of characterizations. Relationships between types of L-closed topological spaces are explored and discussed.

Keywords: L-closed space, Almost L-closed, Nearly L-closed, Weakly L-closed.
Mathematics Subject Classification: 00A05

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The refinement of local fractional Hölder's inequality and its applications

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Abstract: Recently, a whole variety of classical real inequalities has been extended to hold on to certain fractal spaces. A rich collection of generalizations included inequalities with more general kernels, weight functions and integration domains and extension to a multidomensional case. In this paper by using the improved Young inequality and local fractional calculus, a refinement of local fractional Hölder's inequality is given. As an application, a multidimensional version of local fractional Hilbert-type inequalities is obtained.

Keywords: Hölder's inequality, conjugate parameters, local fractional calculus, multidimensional form.
Mathematics Subject Classification: 26D15

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Iyengar-Hilfer Fractional Inequalities

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Abstract: Here we present Iyengar type integral inequalities. At the univariate level they involve psi-Hilfer left and right fractional derivatives. At the multivariate level they involve Hilfer left and right fractional derivatives, and they deal with radial and non-radial functions on the ball and spherical shell. All estimates are with respect to norms $\|.\|_p$, $1 \leq p \leq \infty$ At the end we provide an application.

Keywords: fractional integral inequalities
Mathematics Subject Classification:

Mathematical Modeling of Mixed LDL-C and Blood Flow through an inclined Channel with Heat in the presence of Magnetic Field

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Abstract: We investigated mixed LDL-C and blood flow through an inclined channel with heat in the presence of magnetic field. In the investigation, mathematical models for the mixed LDL-C and blood flow and energy transfer were formulated as a coupled system of partial differential equations (PDEs), the PDEs are scaled using the dimensionless quantities to dimensionless partial differential equations, they are further reduced to ordinary differential equations (ODEs) using the oscillatory perturbation method of which the non-homogenous governing equations are solved directly using the method of undetermined coefficient. The velocity and temperature functions are obtained with some governing parameters involved, and Mathematica codes was developed to simulate the functions to study the effect of the various governing parameters on the flow profiles. It is observed that the governing parameters influenced the flow profiles; also the angle of inclination also influences the flow profile.

Keywords: Blood, Mathematica, PDS, ODE, LDL-C
Mathematics Subject Classification: 76D05, 76D10, 76A02

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Entire sequence spaces on 2-normed space defined by a Musielak -Orlicz function

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Abstract: In this paper we introduce entire sequence spaces defined by a Musileak -Orlicz function $M = (M_k)$, $(\Delta^n_{(vm)})$ is generalized difference operator and $r = (r_k)$ is a sequence of positive real numbers. Also we study various properties and obtain some inclusion relations involving these spaces.

Keywords: Difference operator, Musielak-Orlicz function, Sequence spaces,Entire sequence space, Analytic sequence space.
Mathematics Subject Classification: 40A05, 46A45, 40D05, 46E30

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Shape Differentiability of Semilinear Equilibrium-Constrained Optimization

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Abstract: A class of semilinear optimization problems linked to variational inequalities is studied with respect to its shape differentiability. One typical example stemming from quasi-brittle fracture describes an elastic body with a Barenblatt cohesive crack under the inequality condition of non-penetration at the crack faces. The other conceptual model is described by a generalized Stokes-Brinkman-Forchheimer's equation under divergence-free and mixed boundary conditions. Based on the Lagrange multiplier approach and using suitable regularization, an analytical formula for the shape derivative is derived from the Delfour-Zolesio theorem. The explicit expression contains both primal and adjoint states and is useful for finding descent direction of a gradient algorithm to identify an optimal shape, e.g., from boundary measurement data.

Keywords: Shape Optimization, Solid with non-penetrating crack, Stokes-Brinkman-Forchheimer flow
Mathematics Subject Classification: 49Q10, 74P15, 76B75

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Beyond the Standard Model in Noncommutative Geometry and Dark Matter

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Abstract: Non-commutative geometry can be loosely described as the study of spaces whose algebra of functions is non-commutative. This has been an area of interest to both mathematicians and physicists throughout this century. However, compared with classical geometry (the geometry of spaces whose algebra of functions is commuting) non-commutative geometry was very underdeveloped. Recently this has begun to change with the introduction by Connes [1] and Dubois-Violette [2] [3] of (independent) generalised by Rham differential algebras on the "non-commutative manifold". Since then, non-commutative geometry has been enhanced and refined until, in its present state [4] [5] it is highly developed and contains many of the tools of classical geometry. The purpose of this paper is to seek a connection between noncommutative geometry, and certain aspects of dark matter. The former case is based on a simple mathematical argument showing that the main manifestation of dark matter in connection with flat rotation curves in galaxies and clusters of galaxies is also a consequence of noncommutative geometry. The latter case requires an examination of the local effect of noncommutative geometry and the subsequent extension to the global phenomenon of an accelerating Universe.

Keywords: non-commutative geometry, differential algebras, dark matter
Mathematics Subject Classification: Analysis and Its Applications

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New qualitative results for integro-differential equations with a variable retardation

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Abstract: In this work, a class of nonlinear time varying retarded integro-differential equations is investigated. Three new theorems related to the uniformly asymptotic stability of the zero solution as well as integrability and boundedness of solutions are proved by the functional Lyapunov-Krasovskii method. Two examples are given with their graphs to illustrate the applications of the proposed results.

Keywords: Stability, integrability, boundedness, Lyapunov -Krasovskii functional.
Mathematics Subject Classification: 34D05, 34K20, 45J05.

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Nonlinear Dynamics of Quantum Entanglement

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Abstract: In this work, we will examine in a proof-of-concept experiment a new type of quantum-inspired protocol based on the idea of nonlinear dynamics of quantum entanglement. We discuss various measures of bipartite and tripartite entanglement in the context of two and three level atoms. The quantum entanglement is discussed for different systems. For the three-level systems various measures of tripartite entanglement are explored. The significant result is that a sudden death and sudden birth of entanglement can be controlled through the system parameters.

Applying ψ–Caupto fractional q–derivative to investigate of anti-periodic fractional differential inclusions

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Abstract: In this paper, we investigate the existence of solutions for a class of fractional q–difference inclusions with anti-periodic boundary value conditions with ψ-Caupto fractional q–derivative. By means of some standard nonlinear theorems, sufficient conditions for the existence of solutions for the fractional q-differential inclusions under ψ-Caputo q–derivatives are presented where the real function ψ is increasing. Our result generalizes the known special case if $\psi(t) = t$ and single known results to the multi-valued ones.

Keywords: Multi-Step methods, ψ-Caputo derivative
Mathematics Subject Classification: 34A08, 34B16, 39A13

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Mathematical Models and Comparative Analysis for Rice Irrigation crop water Requirements: A Case Study of Bida Basin Niger State, Nigeria

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Abstract: In this paper, mathematical models for crop water Requirements (C.W.R) and the size of land for irrigation (S.L.I) were formulated. We fill the gap by considering the size of the irrigation land which was not considered by the Food and Agriculture Organization (F.A. O) in CROPWAT 8.0 software. The solutions of the models for Crop Water Requirement for Rice, and the size of land for irrigation (S.L.I) of the crops were obtained. The computational Method of solutions is carried out to get the effective results. The climatic data of the study area (Bida Basin) under which our research is based includes: Rainfall, Humidity, Sunshine hours, minimum and maximum Temperature, evapotranspiration were secondary data collected from Nigeria Metrological Society (NIMET). We compared the results of CROPWAT 8.0 software developed by the Food and Agriculture Organization (F.A. O) and our computational method so that we can arrive to a new finding and better results. The results for the computational method with the size of Land for irrigation shows that there is an increase in crop water need for the crops than the results of CROPWAT 8.0 software developed by Food and Agriculture Organization (F.A. O) in which the size of the land was not considered. We therefore recommended that an integral calculus can be used to estimate irregular shape of the size of the land if the land shape is not in a regular form before solutions is given for accuracy and effective results.

Keywords: Bida Basin, crop water coefficient, evapotranspiration
Mathematics Subject Classification: Applied Mathematics

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Hermite collocation method for solving fractional Lane-Emden type equations with conformable derivative

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Abstract: In this study, Hermite collocation method is used to obtain an approximate solution of fractional Lane-Emden type equations. Conformable derivative is considered for the fractional derivatives. A numerical example is solved and the absolute errors are presented in tables. The obtained results revealed that the method is very efficient to obtain approximate solutions of fractional Lane-Emden type equations with conformable derivative.

Keywords: Hermite polynomials, collocation method, conformable derivative, Lane-Emden type equations.
Mathematics Subject Classification: 65D15, 65L60, 65L70

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Face and Emotion Recognition using Deep Learning Based on Computer Vision Methods

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Abstract: Deep learning studies are among the discipline that are rapidly increasing and developing today. Especially after the concept of big data enters our lives, deep learning methods have used to process the data. In the study, it has aimed to detect the face on the picture determined by the user and to conduct emotional analysis and gender determination with the deep learning methods of the detected face. Viola-Jones algorithm has used for face recognition. "Mini_Xception" model of Convolutional Neural Networks (CNN) has used for emotion analysis and gender detection. Estimation rates have measured with 18 different experiments performed. The most successful emotion recognition has measured as 93,11% and the most successful gender recognition has measured as 90,75. Experiments within the study have supported by visual studies.

Keywords: Deep Learning, Viola-Jones Algorithm, Facial Expression Analysis, Emotion Analysis, Gender Detection.
Mathematics Subject Classification: 68T07

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Asymptotic Behavior of Solutions for a Fractional Integrodifferential Problem

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Abstract: We study the asymptotic behavior of solutions for an initial value problem with a nonlinear fractional integro-differential equation. The involved fractional derivatives are of Caputo or Riemann-Liouville types of orders between 0 and 2. Reasonable sufficient conditions, on the nonlinear kernel and source function under which the solutions behave like power-type functions at infinity, are established. For this purpose, we use and generalize some well-known integral inequalities. Our findings are supported by examples. .

Keywords: Asymptotic behavior, Riemann-Liouville fractional integral, Caputo fractional derivative, integral inequalities, nonlocal source.
Mathematics Subject Classification: 34A08, 35B40, 26D10.

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Power analysis of goodness of fit tests for normality

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Abstract: In modern statistics, goodness-of-fit hypothesis testing is often used to identify the distribution of data set. The problem of correct determination whether a data set follows a normal distribution is being investigated at least since 1900 and remains relevant to the present day. Many goodness-of-fit hypothesis tests have been developed. The Chi-square [1], Kolmogorov-Smirnov [2], Anderson-Darling [3] are the first well recognized tests. The test (with its modifications) developed by Desgagné, Lafaye de Micheaux and Leblanc is an example of a more recent contribution [4]. However, it is not clear how to select the most appropriate test to check the assumption of data set normality.
To tackle this problem a comprehensive study of goodness-of-fit tests, including a newly proposed N-metric test was carried out. The developed test is based on N-metric statistic and uses the proposed kernel function K(x). This test is unique in a way that the shape of its kernel function is chosen to eliminate the shift, which occurs in the evaluation of density for a given data set values. In this study, a power analysis of 40 normality tests was performed. Each test was applied to a randomly generated data sets (of 6 sizes) of 15 data distributions. Based on the results, it is recommended to apply N-metric tests for symmetric data sets of size greater than or equal to 112, for asymmetric data sets of size greater than or equal to 118, and for bell-shaped distributed data sets of size greater than or equal to 88.

Keywords: goodness-of-fit hypothesis, normality test, power analysis.
Mathematics Subject Classification: 62F03, 62E10

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Numerical Comparisons For Solving Fractional Partial Differential Equations

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Abstract: In this paper, multivariate Padé approximation is applied to fractional power series solutions of fractional partial differential equations. Some numerical examples are presented to show the efficiency of multivariate Padé approximation. A comparison of the proposed method is made with the exact solution, Adomain Decomposition Method (ADM), generalized differential transformation method (GDTM) and Homotopy Perturbation Method(HPM). As it is seen from comparisons, multivariate Padé approximation gives reliable solutions and numerical results.

Keywords: Mulivariate Padé approximation, Burgers equation, Fractional partial differential equations.
Mathematics Subject Classification: 65N20, 35R11

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Effect of behavior of predator on prey predator interactions

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Abstract: In this paper,we study the effect of behavior of predators on prey predator interactions. All themodel equilibria have been found and their stability was established. The possibilityof transcritical and Hopf bifurcation was also investigated and numericalsimulation were given. The effect of prey refuge and fear also are detected. Thecost of them allows the model to reach double transcritical points. The effect ofCompetition of prey population is to convert themodel from the stable limit cycle to a spiraltable equilibrium point of afraid prey ,with predator. When it becomeslarge it converts the model to a stable trivial solution.

Keywords: Prey, Prey refuge, Holling type-II functional response, bifurcation.

Numerical solutions of some fractional singular equations

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Abstract: Some problems on the diffusion of heat and its equations in the mathematical physics and fluid dynamic are modeled by singular equations. In this talk, we try to present some nonlinear techniques for numerical solutions of some singular fractional problems. In this way, we use different methods and we compare the results.

Singularly Perturbed Fuzzy Initial Value Problems

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Abstract: In this work, we have firstly introduced singularly perturbed fuzzy initial value problems (SPFIVPs) and then we have given an algorithm for the solutions of them by using the extension principle given by Zadeh. We have presented some results on the behaviour of the α-cuts of the solutions. To show the robustness of the given algorithm, we have fuzzified some examples given in literature and then we have applied the algorithm.
Keywords: Initial Value Problem, Fuzzy Differential Equation, Singularly Perturbed.

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Positive Solutions for Fractional Boundary Value Problems under a Generalized Fractional Operator

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Abstract: The work reported here concerns with study a generalized nonlinear fractional boundary value problems involving θ-fractional derivative in the Riemann-Liouville sense. The existence and uniqueness of positive solutions to the problem at hand are proved. Our discussion relies on the properties of the Green's function, the upper and lower solutions method, and the classical fixed point theorems in a cone. Moreover, building upper and lower control functions have an effective role in the analysis. Some examples are offered to justify the validity of theoretical findings.

Keywords: fractional boundary value problems, Fractional derivative, Control functions, Green's function, Fixed point theorem.
Mathematics Subject Classification: 34A08, 34B15, 34A12, 47H10, 34B18.

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Superquadratic functions in information theory

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Abstract: Using Jensen's inequality and the converse Jensen's inequality for superquadratic functions we obtain new estimates for Shannon's entropy of the random variable X and derive new lower and upper bounds for the Shannon entropy in the terms of the Zipf and Zipf - Mandelbrot's law.

Keywords: Superquadratic function, Jensen's inequality, Shannon entropy, Zipf-Mandelbrot's law.
Mathematics Subject Classification: 94A15, 94A17, 26D15, 26A51

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Generalized Laguerre transforms of sequences

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Abstract: In this talk, we investigate a new class of polynomials which we call the associated polynomials. Firstly, we drive a general identity which generalizes the Laguerre transform of a sequence. More precisely, we give a three-term recurrence formula for calculating the associated polynomials. Secondly, as an application, we define the associated Fibonacci polynomials and give their characteristic properties.

Keywords: Laguerre transform, Associated Laguerre polynomials, Fibonacci numbers, explicit formulas, generating functions.
Mathematics Subject Classification: 33C45, 05A19, 11B83.

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Dynamics of Lump-periodic, breather and two-wave solutions with the long wave in shallow water under gravity and 2D nonlinear lattice

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Abstract: A lump solution is a rational function solution which is real analytic and decays in all directions of space variables. The equation under consideration in this study is the (2+1)-dimensional generalized fifth-order KdV equation which demonstrates long wave movements under the gravity field and in a two-dimensional nonlinear lattice in shallow water. The collisions between lump and other analytic solutions is studied in this work. Using Hirota bilinear approach, lump-periodic, breather and two-wave solutions are successfully reported. In order to shade more light on the characteristics of the acqured solutions, numerical simulations have been performed by means of the 3-dimensional and contour profiles under careful choice of the values of the parameters involved.

Keywords:fifth-order KdV; Hirota bilinear; collision phenomena.

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Optical solitons with the birefringent fibers without four-wave mixing via the Lakshmanan–Porsezian–Daniel equation

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Abstract: This article investigates the optical soliton to Lakshmanan–Porsezian–Daniel (LPD) model in birefringent fibers which incorporates two vector solitons. The optical solitons in the forms of bright, dark, singular, as well as combined form bright-dark, dark-singular, complex soliton and multiple soliton solutions are extracted successfully by the mechanism of Fan-extended sub equation approach with the effect of five free parameters. Furthermore, singular periodic wave solutions are obtained, as well as the constraint requirements for the existence of soliton solutions. The results suggest that the method is simple, direct, and effective, and that it may be applied to more complex phenomena with the help of symbolic calculations.

Keywords: Optical soliton; LPD equation; Extended fan-sub equation method; Generalized elliptic equation

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On the orthogonality of new combination of two orthogonal polynomials sequences

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Abstract: In this paper, we deal with a special case of an inverse problem in the theory of the orthogonal polynomials to analyze of the orthogonality of a monic polynomials sequence $\{Q_n\}_{n\geq 0}$ defined as a linear combination of a sequence of monic orthogonal polynomials sequence $\{P_n\}_{n\geq 0}$ such as

$$Q_n(x) + r_n\, Q_{n-1}\ (x) = P_n(x) + s_n P_n(x) + t_n P_{n-1}(x) + v_n P_{n-2}(x), \quad n \geq 0$$

when $v_n t_n \neq 0$ for every $n \geq 4$. Furthermore, we show that the relation between the corresponding linear functionals is

$$k(x-c)\,u = \left(x^3\ + ax^2 + bx + d\right) v$$

where $c,\ a,\ b,\ d \in \mathbb{C}$ *and* $k \in \mathbb{C}\setminus\{0\}$. We end by giving an illustration for a special case of the above type relation.

Keywords: Orthogonal polynomials, Linear functionals, Inverse problem, Chebyshev polynomials.
Mathematics Subject Classification: 33C45, 42C05.

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